Colorectal Anastomotic Leaks: A Brief Review of Current Literature

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Abstract

Colorectal anastomotic leaks are considered problematic complications after colorectal surgery. Anastomotic leaks result increased rates of patient morbidity, mortality (6%-22%), hospitalization loads, and depletion in healthcare resources. The overall percentage of anastomotic leaks after colorectal procedures is approximately 9% with an increasing rate when the anastomosis is closer to the anal verge. Most incidents of anastomotic leaks are difficult to predict, since they manifest with short notice as fever, sepsis, and fecal fistulae. Anastomotic leaks still occur despite the continuous efforts to establish the best structures and techniques for diagnosis, management and treatment. Many attempts are being made to enhance the healthcare systems in regards to dealing with anastomotic leaks and other colorectal surgery complications. New anastomotic procedures and risk assessments should improve incidence of anastomotic leak and early detection. Additionally future studies could emphasis on protection of the anastomosis when leakage occur. In this brief review, we examine the most common risk factors and their prevalence, preventive measures, diagnostic modalities, and treatment patterns for leak management. Although surgical procedures in colorectal surgery have evolved expansively over the last decades, significant improvements in colorectal postoperative outcomes especially, anastomotic leaks, are not yet observed yet. This suggests that the true pathogenesis of leaks remains covert and requires further research. Cooperative efforts should be made regarding the proper diagnosis and management of anastomotic leaks. The technique of performing anastomosis remains at the judgment of surgeons and depends mainly on knowledge, patient status and the operative settings, rather than any verification of one techniques superiority over another.

KEYWORDS: colorectal, anastomosis, leak
Introduction

Anastomotic leak after colorectal surgery is a dreadful complication that might occur following the joining of any two bowel segments to accomplish luminal continuity (1). It is most prone to occur after the formation of a low rectal anastomosis which significantly increases patient morbidity and mortality (6%-22%) (2, 3). Morbidity is greatly increased compared to patients who do not develop leaks. Patients with leaks are more likely to suffer reduced rectal capacity, defecation predicaments, fecal urgency, incontinence, and worse oncologic outcomes, while requiring re-operative interventions, permanent stoma (4), and radiological interventions in 56% of cases (5).

The definition of "leak" is very versatile and never explicit in medical literature. Although great numbers of studies feature the rate of anastomotic leak, risk factors, and preventive techniques; there is not an established definition of an “anastomotic leak.” Additionally, the incidence has not decreased. In an attempt to identify the prevalence of anastomotic leaks after gastrointestinal surgery, Bruce et al. performed a systematic review on 97 published studies; and a total of 56 separate descriptions of anastomotic leak were noted in three main sites: upper gastrointestinal, hepatopancreaticobiliary and lower gastrointestinal (6). Leaks are characterized by the requirement for re-operation, clinical findings, or radiologic criteria. However comparison of rates between medical institutions remains difficult and depends on the use of standard definitions and methods of measurement. Furthermore, a frequent “cut-off” at 30 days postoperatively and/or hospital discharge for diagnosis is often present, but it usually masks the reporting of late insidious leaks that might ensue as proven by Hyman et al. (1).

Up to this date, a structured classification of leaks has not yet been defined. Grouping anastomotic leaks relies on the presentation of a leak at the organ site. Minor leaks are silent without any systemic manifestations, and can only be diagnosed using radiologic studies, which appears as a small amount of contrast contained in a cavity next to the lumen of the anastomosis. They typically require no surgical intervention. Major leaks present with systemic symptoms as fever, hemodynamic instability, sepsis, and peritonitis requiring additional surgery. Radiologic studies in these cases usually show an evident defect in the anastomosis, with contrast freely extravagating through the lumen into the peritoneal cavity (6). Leaks of fecal material from an anastomosis may cause generalized peritonitis with increased mortality, localized peritonitis associated with abscess formation, or fistula formation (7). Understanding the myriad of consequences helps in applying the suitable management, and hence a better prognosis (8).
A considerable variation between series was reported in overall leak rates, ranging from 3.5% to 6% (9, 10). Nevertheless, clinically significant leak rates range between 3-15% (6). The documented rates greatly depend on the inclusion criteria of leaks; therefore the majority of series report clinically relevant leaks, ignoring minor leaks (6, 9). Differences in leak rates of anterior resections in the sigmoid colon are noticed, with the incidence being higher as the anastomosis falls lower towards the rectum, due to poor vascularity and tension that ensues as the descending or transverse colon is brought down to the stump of the rectum. The lower the anastomosis is, the higher becomes the possibility of poor vascular supply since the colon is being nourished by single marginal artery collateral circulation rather than a specific pedicle such as the inferior mesenteric artery (10). Extra tension on the descending colon and the irradiated distal rectal stump increases the risk of developing anastomotic leakages (4-26%), which contributes to higher mortality and risk of permanent stoma (11).

**Risk factors for anastomotic leak**

An exact understanding of risk factors could decrease anastomotic leaks and help set better indications for diverting stomas. Detailed literature is available on the risk factors for anastomotic leakage. Among other factors are obesity, smoking, gender, alcohol abuse, preoperative steroids, non-steroidal anti-inflammatory medications use, longer operation time, pre-operative blood transfusions, and contamination of operative site (12-14). Increasingly, the "position" of the anastomosis is rendered the most important risk factor associated with anastomotic leaks that were investigated in several previous publications, as most anastomotic leaks occur in the low rectal anastomosis, which is below the peritoneal reflection (15). A multivariate analysis done on several patients and operative variables, including indication for operation, co-morbidities, bowel preparation and intra-operative events showed that merely a distance of less than 7 cm (< 7 cm) from the anal verge is a significant risk factor for the development of anastomotic leaks (16). Other independent significant factors that can contribute to higher leak rates include leukocytosis, sepsis, technically challenging anastomosis, chronic obstructive lung disease, bowel obstruction, peritonitis, and hypoalbuminemia, (7, 9, 17, 18). Another study showed that preoperative variables associated with leaks in colorectal anastomosis include weight loss, malnutrition, cardiovascular diseases, and other co-morbidities (19). Factors other than a short distance to the anal verge include ASA status (American Society of Anesthesiologists physical status classification), protracted surgery, high body mass index, bowel preparations, anastomosis type, technique
of stapling, and use of drains. Laparoscopic surgery for colorectal resection does not add any risk to the development of leaks as shown by the surgical therapy study group (20). Leak rates in patients with Crohn’s disease are similar to other groups (9.7%), however the fistulae rate is significantly higher (21). Ulcerative colitis (UC) patients undergoing restorative proctocolectomy have a leak rate of around 6% (22, 23). Radiotherapy in multivariate meta-analysis studies was found to be insignificant regarding the difference in leak rates between patients with preoperative and patients with postoperative radiation; however, the former group showed elevated complication rates (24). Furthermore, the Dutch TME (total mesorectal excision) Radiotherapy trial failed to show any difference between the two groups (25). The universal causes of leaks are multi-factorial including excessive tension across anastomosis, distal obstruction, poor surgical technique, and ischemia of the intestinal joining segments at the suture/staple line (6, 9, 10, 26). Identification of risk factors for leaks leads to precautionary measures. Intra-operative testing of the anastomosis, fecal diversion, and pelvic drainage has been reported in a number of studies to reduce the serious consequences of anastomotic leaks (27-29).

A remarkable contribution in the objective testing of the risk of anastomotic leaks, Dekker et al. developed and tested the Colon Leakage Score (CLS). For the development of this score, multiple risk factors were collected and points were assigned to the patients per risk factor. CLS had successfully predicted the area under curve of the receiver-operating characterized curve (AUC 0.95, 95%CI: 0.89-1.00), and an odds ratio of 1.74 (95%CI: 1.32-2.28). This scoring tool is unique in its ability to detect patients at risk of developing anastomotic leaks preoperatively and objectively assess the need for diverting ileostomy or non-restorative surgery (30).

Preventive measures to minimize the incidence of leaks

The universal guidelines that are generally followed by surgeons to achieve the best outcomes when performing an anastomosis are collectively recognized as absence of distal obstruction, tension free anastomosis, and an adequate blood supply to the two sides of the anastomosis (6, 31, 32). Several reports showed no significant differences between stapled and hand-sewn techniques, even with the expanding advances in surgical technology and stapling devices (33). Delivery of adequate oxygen tension to meet the metabolic demands of the healing process is crucial, as shown by Sheridan et al. This is optimized by maintaining an adequate cardiovascular status pre-operatively by preservation of blood pressure, hemoglobin level, and blood oxygen saturation (34).
The splenic flexure has to be mobilized and descending colon brought distal if necessary to achieve a tension free anastomosis. This would release the tension and ensure an adequate blood supply in the proximal limb of the anastomosis. It has been shown that the descending colon has a better oxygen tension than the sigmoid colon after IMA ligation (35). Tension free mobilization of the descending colon also ensures that the dead space in the pelvis is adequately filled with bowel to minimize complications and subsequent postoperative collections (15). Malnutrition has also been associated with an amplified risk of leak, namely the serum albumin level < 30 g/dl along with recent incidents of weight loss of > 5 kg are known to be risk factors (9, 36). Early postoperative feeding is recommended to decrease the time needed for recovery without any effect on leak rates (37). Bowel preparations were historically used extensively prior to colorectal procedures, but later shown to have no influence on leak rates, hence the latest trend is avoiding bowel preparations which may cause dehydration, electrolyte imbalance, and starvation pre-operatively (38). Drains have been controversial for low rectal anastomosis, and data suggests that draining a low anastomosis gives a false sense of security, induces infections, and causes fistula formation by mechanically disrupting the anastomosis (39). However, some authors support the use of drains in low rectal anastomosis, where the drain helps to evacuate collections that might otherwise erode through an anastomotic suture or staple line to drain (40). A covering stoma is recommended when there is a low anastomosis, a poor preoperative patient condition, a technical difficulty, a positive air leak test, or a patient with numerous risk factors for developing leaks. Traditionally, stomas were thought to reduce the risk of developing clinical consequences of leaks but do not diminish the risk of leak (41). However, a recent review by Montedori et al. showed the opposite and proved that the use of stomas decrease both the occurrence of leaks and the incidence of reoperation due to a leak (42).

**Diagnosis of leaks**

Any clinical deterioration and signs of sepsis should raise a suspicion for a leak. Sometimes clinical deterioration is complimented by a high increase in bilirubin and amylase levels in the abdominal drain fluid compared to blood levels. Patients with an anastomotic leak may illicit fever, new onset pelvic pain, ileus, renal failure and leukocytosis (19). Complimentary radiologic studies such as computed tomography (CT scan) or contrast water-soluble enemas can be used to confirm the diagnosis; CT scan is superior to the latter in showing abscess formation in the pelvis (19, 43). The establishment of an early diagnosis with a CT scan is
necessary for prompt therapy to improve the final outcome of the patient especially in regards to mortality. The presence of a collection of fluid and gas neighboring the colonic suture/staples is indicative of an anastomotic leak. When suspicions persist, the leak can be more illustrated with intestinal opacification and using fluoroscopic imaging. If uncertainty remains, conventional contrast enemas pursued with a supplementary CT examination at the same time that might show an intestinal wall defect with communication of the intraluminal and extraluminal compartments (44). The implementation of uniform definitions of anastomotic leaks improves the diagnostic knowledge for a better treatment approach. In a study done by den Dulk et al., the clinical features were combined into a clinical scoring system (Dutch LeaKage (DULK) Score), where patients were scored every day in a uniform way. Points are assigned to certain clinical manifestations and symptoms (i.e., fever, heart rate), nutritional level (signs of ileus, gastric retention, kind of intake) and laboratory findings (i.e., CRP level, kidney function test, leucocyte level). After applying, the scoring system retrospectively on a historical cohort, the score was used prospectively. It was reported that patients with a higher score were susceptible to anastomotic leaks, and required intensive medical care or radiological evaluation. This scoring system decreased the delay in detecting the anastomotic leak from 4 to 1.5 days, decreasing the false negative diagnostic imaging which is considered a major factor in the diagnosis delay (45,46). It is not yet known if the use of this scoring system increases negative imaging, this scoring could come handy in routine clinical practice where physicians and clinicians could identify patients at high risk more easily. Moreover, it could improve the research area if applied universally.

The period between operation and clinical manifestations of symptoms, implies the presence of a preclinical stage in which non-clinical procedures could be used to predict a leak. Additionally, routine measurement of C-reactive protein (CRP) postoperatively has been used for detecting the presence of any infectious complications after surgery and in particular anastomotic leaks. Warschkwow et al. showed a meta-analysis, including six studies, a cut-off of 135 mg/L on day 4 post surgery resulting in a negative prediction value of 89% for infections and complications (46, 47). CRP and other biochemical blood parameters are measured and studied to detect systematic complications, while other procedures are implemented to detect local and anastomotic changes in ischemia and metabolism. Microdialysis is currently in use to detect any changes in oxygenation locally at the anastomosis site using an indwelling two-lumen catheter. A few studies showed the capability to distinguish patients with anastomotic leaks after rectal resection from patients with no complications, however, these studies do not have enough samples to provide the best predictive
values (49,50). Future beneficial studies should emphasize on the preclinical detection of anastomotic leaks, since patients that undergo reoperation in an early stage could avoid septic consequences of anastomotic leaks.

Management of leaks

Major leaks
Patients with major anastomotic leaks develop hemodynamic instability, which requires immediate intervention with resuscitation, IV antibiotics, monitoring with central lines, urinary catheters, and arterial lines in an intensive care setting. After stabilization, laparotomy with lavage and drainage is mandatory, followed by the formation of a de-functioning stoma. In right sided colonic leaks, the anastomosis can be refashioned and adequate drainage achieved with a drain. In left sided leaks and depending on the condition of the anastomosis, the surgeon decides the appropriate measures to be taken. If the anastomosis has a small clear defect, it is closed and a stoma is fashioned with adequate drainage of the abdominal cavity. Moreover, if the anastomosis has completely broken apart, the proximal end is brought out as a colostomy and the distal end is either closed and left inside the abdomen or, length permitting, is brought out as a mucous fistula (51). Postoperatively, it is best that the patient is optimized in an intensive care unit (ICU) setting to monitor the filling pressures by Swan-Ganz or central venous lines to avoid massive fluid shifts as it often happens in septic patients. Whenever a clinician is faced with a leak, they have to take into consideration several aspects, as age, gender, health status of the patient, degree of dehiscence, period between operation and re-operation, indication of primary resection, presence of diverting stoma, and location of the anastomosis. These variables represent a drawback in defining a standard outline for treatment, since they lead to individualization of treatment methods and incomparable results. Nevertheless, several reports showed that anastomosis can be repaired rather than dismantled, where preservation of the anastomosis could be a major outcome (52-54).

Leaks with localized consequences
The management depends on the presentation and investigation using CT scan with water soluble contrast. Upon the presentation of a minimal leak contained in a small cavity, the treatment is conservative with IV antibiotics. If the leak is contained in a large cavity, then the best approach is achieved by percutaneous drainage under radiologic guidance with a success rate of 80% (55). If drainage under radiologic guidance is not feasible, then surgical intervention is required. If the contrast is free flowing in the abdomen then laparotomy is also necessary (51).
Fistulae and strictures

Fistulae occur when the anastomosis leaks and a collection develops in the vicinity. Consequently, the collection finds its way through the skin or an adjacent visceras like the vagina, the bladder, or the small bowel. In the absence of peritonitis, the treatment is usually conservative with parenteral nutrition, elemental diet, and elimination of distal obstruction. The more distal the fistula, the less likely it will close and a surgical repair is warranted. The use of bioprosthetic material like fibrin glue and animal collagen products like the Surgisis® were described in literature for closure of distal fistulas with uncertain results (56). Stricture formation in the site of the anastomosis is mainly due to anastomotic leak or ischemia followed by cancer recurrence (57). The stricture is repaired when there is a need to reverse a proximal stoma, luminal obstruction, or defecatory symptoms. Additionally it may be necessary to address an asymptomatic anastomotic stricture when it is needed to survey proximal bowel upon failure to pass a colonoscope through the stricture. Dilation with endoscopic bougie or Hegar dilators can be deployed (58).

Conclusions

Colorectal anastomotic leaks are serious complications that impose a heavy clinical burden on patients, putting healthcare practitioners in consistent prevention, detection, and management dilemmas. Despite the advancement in surgical practice and technology, a significant improvement in colorectal postoperative outcomes especially anastomotic leaks has not yet occurred. This signifies that anastomotic leaks remain a challenging complication which require further investigation and research. Accepted best practice strategy to prevent anastomotic requires performing a tension free, well vascularized, and unobstructed anastomosis. Furthermore, the anastomosis should be tested intra-operatively and if warranted covered by a de-functioning ileostomy. The technique of performing anastomosis remains at the judgment of surgeons. Currently, optimal suturing techniques are deployed, using slowly absorbable monofilament sutures applied in a continuous, inverting, single layer manner or stapling. Other factors that affect the outcome of colorectal surgery depend on the surgeon’s experience, patient status and the operative setting, rather than the superiority of one technique over another. Other factors must not be overlooked such as intestinal microbes and immunity. Early detection plays a key role in managing leaks. Leakage scoring systems and clinical laboratory tests (CRP at postoperative day 3-4) contribute strongly to the early detection of leaks. More in
depth studies should be conducted to unveil the indefinite aspects of anastomotic leaks. The development of new techniques and devices that prevail over the disadvantages in present practice should be consistently developed and tested.

References


