The Role of Temporary Fecal Diversion

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Abstract

Keywords

- diverting ostomy
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- stoma

The use of temporary fecal diversion is of great importance to tenuous anastomosis, immunosuppressed patient, or actively infected patient. Its use protects newly constructed intestinal anastomoses from being the culprit of pelvic sepsis or systemic illness. Thus, potential morbidity and mortality can be averted. However, its appropriate or optimal use is often debated. We herein discuss the evidence for when to best use a diverting stoma for colorectal, coloanal, and ileoanal anastomoses. We also discuss the importance of considering a temporary diverting stoma in the setting of high-dose immunosuppression (e.g., transplant patients or inflammatory bowel disease), active infection, or upon creation of ileal pouch–anal anastomosis. Lastly, we discuss the advantages and disadvantages of a loop ileostomy versus colostomy for temporary diversion of fecal contents.

The role of temporary fecal diversion remains an area of controversy among surgeons for patient-specific scenarios. Its use can be of great importance in protecting tenuous anastomoses in the pelvis, for patients who are immunocompromised, or for patients who are acutely septic. Although fecal diversion does not prevent an anastomotic leak, it does avert the potential morbidity and mortality from an anastomotic leak. And, for patients undergoing ileal pouch–anal anastomosis (IPAA), the lifelong function and preservation of the pouch can be optimized by preventing pelvic sepsis. Diversion is not without consequence, however. Patients are subjected to additional operations and may develop small bowel obstructions related to the diverting ostomy, acute kidney injury due to a high stoma output, a parastomal hernia, or complications at the time of ostomy reversal. However, all these disadvantages need to be carefully weighed against the potential consequences of the anastomotic leak in a variety of anatomical scenarios and patient-specific scenarios. We herein discuss the evidence for when to best use a diverting stoma for colorectal, coloanal, and ileoanal anastomoses. We also discuss the importance of considering a temporary diverting stoma in the setting of high-dose immunosuppression (e.g., transplant patients or

inflammatory bowel disease [IBD]), active infection, or upon creation of IPAA. Lastly, we discuss the advantages and disadvantages of a loop ileostomy versus colostomy for temporary diversion of fecal contents.

Tenuous Anastomoses

An anastomotic leak is the dreaded complication after a colorectal resection with significant morbidity¹ and mortality (6–22%).² One can anticipate that anastomotic leakage may occur in a medically fragile patient, or after a technically difficult operation, or if intraoperative adverse events were present. However, anastomotic leakage also occurs in patients with no obvious risk factors.³ The difficulty in predicting anastomotic leakage has generated several studies in recent years with the aim of identifying risk factors for anastomotic leakage.^{2–5} Extensive literature has described many risk factors for an anastomotic leak including male gender, smoking, obesity, alcohol use, preoperative steroids, longer duration of operation, preoperative transfusion, contamination of the operative field, case volume of rectal surgery, ASA (American Society of Anesthesiologists) class III or IV, and distance from the anal verge.^{6–13}

Low Colorectal Anastomosis

In the era of increased sphincter sparing surgery for rectal cancer, increasingly distal anastomoses are being performed in the setting of neoadjuvant chemotherapy and radiation. Several studies have looked at diversion at the time of low anterior resection (LAR). Matthiessen et al¹⁴ performed a randomized controlled trial (RCT) to look at the symptomatic anastomotic leak rate following LAR for rectal cancer with and without a defunctioning stoma. Among 234 patients who underwent an LAR, the overall symptomatic leak rate was 19.2%; patients randomized to a defunctioning stoma had a 10.3% leak rate versus 28% in those without a stoma, and the need for urgent abdominal reoperation was 8.6% in patients with a stoma versus 25.4% in those without. The authors therefore concluded that a defunctioning loop stoma decreased the rate of symptomatic anastomotic leakage among patients undergoing an LAR for rectal cancer. A 6-year longitudinal follow-up after the initial LAR found that 19% of patients received a permanent stoma within the study period, and the risk of permanent stomas was significantly higher in patients with symptomatic anastomotic leakage versus those without (56 vs. 11%).¹ The same group later published their results that a defunctioning stoma after an LAR does not affect anorectal function evaluated at 1 year, further supporting the use of a temporary stoma.¹⁵ Another group from Germany performed an RCT of 256 patients undergoing an LAR to evaluate the utility of a diverting loop ileostomy. The group found 12 leaks (10%) versus 3 leaks (2%) in the nondiverted group and the diverted group, respectively. Two patients (17%) without an ostomy who leaked were taken back to the operating room for Hartmann's procedure, whereas all patients who were diverted and who leaked recovered without the need to reoperate on the anastomosis.¹⁶ Another smaller RCT performed in parallel by a group in Germany randomized 34 patients to stoma versus nonstoma.¹⁷ The symptomatic leak rate was significantly higher in the nonstoma group (37.5%) than in the stoma group (5.5%), and in all cases of leaks in the nonstoma group, reoperations were necessary.¹⁷

Several meta-analyses of these RCTs have been performed, confirming the finding that diversion is preferred following LAR for rectal cancer. The most recent meta-analysis included the aforementioned four RCTs in addition to nine additional nonrandomized studies with a total population of 8,002 patients, of whom 3,562 had a protective stoma and 4,440 did not. The meta-analysis demonstrated that the absence of a protective stoma was associated with a significantly higher incidence of anastomotic leak and reoperation. This underscored the significant advantage conferred by a protective stoma in patients undergoing LAR.¹⁸

Coloanal Anastomosis

When rectal cancers abut the pelvic floor near the anorectal ring, coloanal anastomosis may be indicated. This ultralow anastomosis, performed either hand-sewn or stapled depending on the precise location of the tumor, is nearly uniformly diverted with little controversy. In general, the primary concern of diverting a patient with a coloanal

anastomosis is anal stricture, which can occur in up to 8% of patients.¹⁹ However, diversion alone is not the primary cause of anal stenosis. Neoadjuvant radiation therapy has been reported to increase the stricture rate of coloanal anastomoses,^{20,21} and permanent diversion rates in patients after coloanal anastomosis, in the setting of radiation therapy, have been reported as high as 24%.²¹ Since the anastomoses are often too low for repeat resection, strictures are treated with repeated dilations and ileostomy takedown.¹⁹

Ileorectal Anastomosis

Ileorectal anastomoses have a high risk of leak, up to 23%, which is significantly higher than colorectal or ileoanal anastomosis.²² Most of the literature regarding ileorectal anastomoses comes from patients with IBD. Before the development of the IPAA in the 1980s, patients with ulcerative colitis (UC) who did not want an end ileostomy were offered the option of an ileorectostomy. Additionally, patients with rectal sparing Crohn's colitis may undergo ileorectostomy if medical management fails. The reported leak rate from this patient population undergoing ileorectostomy is 2 to 7% with diverting ileostomy at the surgeon's discretion.^{23–27} The majority of patients in these series who ended up with a permanent stoma experienced a flare of the underlying disease and not an anastomotic complication.

In addition, patients undergo ileorectostomy for slow transit constipation or familial adenomatous polyposis (FAP), or other disease processes in addition to IBD. A study comparing the leak rates following ileorectostomy by patient diagnosis found a leak rate of 4.2% among patients with colonic inertia, 1% among patients with Crohn's disease (CD), and 0% among patients with FAP or neoplasia.²⁸ Other studies have also noted a significantly higher leak rate among patients undergoing subtotal colectomy with ileorectal anastomosis for delayed transit or colonic inertia, implying the disease process may play a role.²²

Special High-Risk Scenarios

Immunosuppressed Patients

Immunosuppressed patients are considered an at-risk patient population after rectal anastomoses for two reasons. First, a myriad of immunosuppressive medications have been implicated in delayed or impaired wound healing. Second, immunosuppressed patients are less likely to tolerate an anastomotic leak. Several patient populations are considered immunosuppressed, including HIV patients, transplant patients, and any patients taking chronic steroids. We will focus our discussion on solid organ transplant patients and patients with IBD.

Solid organ transplant recipients and patients with IBD are often maintained on a multitude of immunosuppressive medications including steroids, biologics, cyclosporine, azathioprine, tacrolimus, and sirolimus. Of the many classes of therapeutics, steroids are the mainstay of most regimens. More than 90% of solid organ transplant patients are maintained on steroids, and up to 28% of patients with CD and 22% of patients with UC are steroid dependent.²⁹ Since steroids

and biological therapies are the most commonly administered drugs for colorectal surgery patients with organ transplantation or IBD, these have been the most studied regarding their perioperative use and risk of an anastomotic leak.

Corticosteroids

Corticosteroids exert immunomodulatory and anti-inflammatory effects through the inhibition of antigen processing, T-cell activation, macrophage function, and cytokine production. Due to the inhibitory effect on the inflammatory response, systemic corticosteroid therapy is known to impair wound healing in several clinical scenarios. Thus, steroid use becomes an important consideration in the decision of whether or not to divert an intestinal anastomosis.

The effect of steroids on anastomotic healing remains a controversial topic. Several studies have concluded that systemic corticosteroid treatment is not associated with an increased rate of anastomotic leaks or infectious complications,^{30–33} whereas others have reported an increased anastomotic leak rate.^{34–37} A systematic review attempting to resolve the disparity of opinions reported an anastomotic leak rate of 6% among patients receiving steroids versus 3% in those who did not. Despite this being a nonsignificant difference, the authors suggested using caution in lower gastrointestinal surgery in the setting of preoperative steroid use.³⁸

Biological Therapy

Biological therapies have grown to play a significant role in the treatment of IBD. The dominant, and initial class of biologics, are the tumor necrosis factor- α (TNF- α) inhibitors including infliximab, adalimumab, certolizumab, and golimumab. Recently, several additional biological drugs have been approved for the treatment of IBD that work through different anti-inflammatory mechanisms such as blocking integrins (natalizumab and vedolizumab) or interleukin (IL)-12/23 (ustekinumab).³⁹

The most well-studied biological therapy is infliximab. The initial studies of infliximab among IBD patients showed an increased risk of opportunistic infections and sepsis.³⁰ This generated concern that surgical patients receiving infliximab would have increased postoperative infectious and anastomotic complications. Thus, several studies evaluating infliximab's contribution to postoperative morbidity followed. Some failed to demonstrate a significant increase in anastomotic leak rates among patients receiving infliximab prior to surgery,^{30,40,41} whereas others noted an increase in anastomotic complications among patients with CD⁴² and UC,⁴³ and early pouch-specific complications following IPAA.⁴⁴ Due to these mixed results, meta-analyses were conducted. One found no conclusive evidence that anti-TNF treatment increased anastomotic complications,⁴⁵ whereas another found the therapy did increase the rate of anastomotic complications.⁴⁶ Unfortunately, this remains a controversial topic and requires surgeons to use their own judgment when operating on a patient who has received recent biological therapy. And, as new biological therapies

are approved by the U.S. Food and Drug Administration, further study will be needed to evaluate their potential impact on postoperative complications.

With the literature in flux, exercising intraoperative judgment of whether to divert or not becomes important; patients who are solid organ transplant recipients, or IBD patients with refractory medical disease on several immunosuppressive agents, will likely not have the medical reserve to tolerate a leak, and thus it is probably wise to divert such patients.

Active Infection or Gross Spillage

Active infections, such as peritonitis from diverticular disease or gross spillage from a gunshot wound, have historically been indications for Hartmann's procedure without formation of a primary anastomosis. However, the recent trauma literature has supported performing a primary anastomosis with diversion even in the setting of gross contamination.⁴⁷ In parallel, literature regarding operative strategy for diverticulitis with peritonitis had similar findings—primary anastomosis with diversion was preferred to Hartmann's procedure and end colostomy^{48,49} since Hartmann's procedure was associated with a higher complication rate (44%) and mortality rate (1.7%).^{50,51} Additionally, a systematic review of 15 studies on the topic of diverticulitis with peritonitis concluded that primary anastomosis with diversion was preferred over Hartmann's procedure due to decreased mortality in the emergent setting.⁵² The trauma literature and diverticulitis literature thus share common findings: decreased mortality with primary anastomosis and diversion as compared with Hartmann's procedure, decreased rate of permanent ostomy with primary anastomosis and diversion as compared with Hartmann's procedure, and diversion among all patients who are given a primary anastomosis at the time of the operation.

Ileal Pouch–Anal Anastomosis

IPAA is the procedure of choice in patients with UC and FAP since it removes the offending disease process while maintaining intestinal continuity.⁵³ Because the operation includes colectomy, proctectomy, ileal pouch formation, and potential diversion, it has been described in a single-, two-, or three-stage fashion. A single-stage IPAA, proctocolectomy with ileal pouch formation performed as one operation without ileal diversion, has been reported in several series. It has the advantage of a single operation as opposed to two or three, decreased complications related to diverting ileostomies, and decreased incidence of anal strictures.^{54,55} Some single-center series have reported no difference in anastomotic leak rates or pouch complications with single-stage versus two- or three-stage IPAA.^{54,56} One report noted that if patients do experience a leak, sepsis can be controlled without an operation.⁵⁷ Some authors advocate the use of single-stage IPAA in carefully selected patients (e.g., no tension at anastomosis and no prolonged use of steroids),^{55,56,58} and one group even concluded this regardless of reporting a higher leak rate without diversion.⁵⁶ It is important to note that most of these studies

were conducted prior to the introduction of biological therapy. Thus, patients were on less immunosuppressive medication and potentially had decreased disease severity at the time of operation. Today, given the amount of aggressive immunosuppression given to nearly all patients with UC, single-stage IPAA is not indicated because the lack of diversion puts the patient at high risk for early pouch-related anastomotic complications⁴⁴ and pelvic sepsis (the leading risk factor for pouch excision⁵⁹), and postoperative morbidity following pouch excision.⁶⁰

A two-stage IPAA consists of proctocolectomy, IPAA, and diversion. Diversion has been shown to improve septic complications related to a leak⁶¹ and to decrease the number of anastomotic complications.⁶² A three-stage IPAA, which starts with a total abdominal colectomy, rectal oversewing or rectal mucous fistula, and end ileostomy, initially gives patients an opportunity to wean off immunosuppressive medications and recover their wound healing capabilities before undergoing a pelvic dissection with proctectomy and creation of an ileal pouch. However, some groups have shown no difference in infectious complications between patients who are on systemic steroids and those who are not and advocate that preoperative systemic steroid therapy does not necessarily warrant a three-stage approach.^{33,63–65} Similarly, some centers argue that preoperative anti-TNF- α therapy in patients with UC has not and should not increase the number of three-stage pouches.^{33,66,67} Additionally, one large single-center study documented that a three-stage IPAA did not have a lower anastomotic leak rate as compared with a two-stage IPAA, and in fact had a higher rate of anal stricture.³³ This group concluded that a three-stage IPAA may be overused in patients with UC.

However, it is important to remember that an ileal pouch involves a tenuous anastomosis to the anus, which is, in addition, usually double stapled. Pouch sepsis related to an anastomotic leak results in significant morbidity and is the leading cause for pouch excision.⁵⁹ Pouch excision results in a permanent end ostomy without a chance for a pouch revision or future restoration of intestinal continuity in the majority of patients and can result in significant morbidity due to chronic wound complications.⁶⁰ Additionally, pouch sepsis related to anastomotic leaks has been shown decrease quality of life as measured by the overall Cleveland Global Quality of Life score.⁶⁸ Thus, in the era of biological medications, when many IBD patients are treated with a “cocktail” of immunosuppressive medications, a three-stage approach is being employed by many surgeons to prevent pouch sepsis and its associated complications. While the disadvantages of a three-stage operation include additional operations, small bowel obstructions, and readmissions for dehydration from high ileostomy output, these are arguably less devastating than pouch sepsis.

Loop Ileostomy versus Colostomy

Several meta-analyses have compared loop ileostomy to loop colostomy for fecal diversion following a colorectal or coloanal anastomosis.^{69–73} A Cochrane Database Review in 2007 examined five studies that evaluated the safety and effectiveness of a loop ileostomy versus loop transverse

colostomy for temporary diversion. Although the authors did not find ileostomies superior to colostomies, they did find significantly higher rates of stoma prolapse among the loop colostomy group, suggesting a benefit to ileostomy. Tilney et al⁷³ looked at seven studies including three RCTs, and found that loop ileostomy may be preferable, due to decreased wound infections and overall complication rates, despite higher outputs. Güenaga et al⁷⁰ looked at five RCTs and found a significantly higher rate of stoma prolapse among diverting loop colostomies. Rondelli et al⁷² looked at sphincter-saving surgery for the treatment of middle and low rectal cancer to compare the use of a diverting loop ileostomy versus colostomy. They looked at 12 comparative studies including five RCTs and found that among 1,529 patients, a loop ileostomy reduced the risk of prolapse at the stoma site, hernia after stoma closure, and risk of sepsis, but was associated with a higher risk of bowel obstruction after stoma closure and dehydration due to high stoma output. Chen et al⁶⁹ looked at 12 studies, of which five were RCTs, and found that each type of diversion had its own advantages and disadvantages and could not conclude superiority of one over another.

Overall, the majority of studies conclude that loop ileostomies and colostomies are equivalent functionally. The several studies comprising the meta-analysis consistently suggest that the disadvantages of a loop ileostomy are the potential for high output resulting in acute kidney injury and small bowel obstruction due to adhesive disease while the disadvantages of a diverting colostomy are the rate of parastomal hernia formation and prolapse. Importantly too, loop colostomy, if performed in the sigmoid colon, decreases the options available for reconstruction in the pelvis. A loop transverse colostomy is notoriously difficult to manage compared with an ileostomy. Also, closure of a loop colostomy can be a major procedure requiring opening the abdomen, something that is a rare occurrence when closing a loop ileostomy.

Conclusions

The effectiveness of proximal diversion whether achieved by loop ileostomy or colostomy remains controversial. Most studies have focused on determining if diversion prevents an anastomotic leak or mitigates the consequences related to a leak. Moreover, potential added morbidity, including volume depletion with acute kidney injury, small bowel obstruction in up to a third of patients,⁷⁴ readmission in nearly a fifth of patients, and complications with ostomy closures in another fifth of patients,^{75,76} need to be factored into any decision to construct a diverting stoma. There is reasonably sound data supporting a decision to divert patients undergoing LAR, coloanal anastomosis, emergent surgery for diverticulitis, and formation of IPAA; diversion likely does not prevent but rather lessens the impact of an anastomotic leak. It is therefore important that the surgeon weighs the risks and benefits of constructing a stoma while remembering that the consequences of leak and resulting pelvic sepsis are dire.

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