Considerations in Stoma Reversal

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Abstract

Temporary stomas are frequently used in the management of diverticulitis, colorectal cancer, and inflammatory bowel disease. These temporary stomas are used to try to mitigate septic complications from anastomotic leaks and to avoid the need for reoperation. Once acute medical conditions have improved and after the anastomosis has been proven to be healed, stomas can be reversed. Contrast enemas, digital rectal examination, and endoscopic evaluation are used to evaluate the anastomosis prior to reversal. Stoma reversal is associated with complications including anastomotic leak, postoperative ileus, bowel obstruction, enterocutaneous fistula, and, most commonly, surgical site infection. Furthermore, many stomas, which were intended to be temporary, may not be reversed due to postoperative complications, adjuvant therapy, or prohibitive comorbidities.

Keywords

- stoma
- ileostomy closure
- Hartmann's reversal
- colostomy closure

A temporary diverting, or defunctionalizing, ileostomy is frequently constructed to protect low colorectal, coloanal, or ileorectal anastomoses. Although they do not prevent anastomotic leaks, they can minimize associated morbidity such as sepsis, peritonitis, poor neorectal function, or cancer recurrence. Loop ileostomies are favored over loop colostomies because they are less bulky, less malodorous, less prone to prolapse, and associated with fewer complications upon reversal.[1] Loop ileostomy closure is associated with a morbidity of 17.3% mortality of 0.4%. Most patients undergo ileostomy closure with a peristomal incision; however, 3.7% of patients require a laparotomy. The most frequent complications associated with ileostomy closure include wound infection (5%) and small bowel obstruction (7.2%).[1] Smoking increases the risk of postoperative wound infection by more than twofold.[2]

Temporary colostomy, as in a Hartmann's procedure, is used in the setting of perforated diverticulitis or other left colon perforation. Reversal of a Hartmann's procedure can be difficult with a morbidity rate of more than 50%,[3,4] and as a result, many patients never undergo stoma reversal. The most frequent complications following Hartmann's reversal are sepsis, wound infection, and ileus.[4] Increasingly, Hartmann's reversal is being performed laparoscopically with decreased morbidity, length of stay, and more rapid return of bowel function.

The Essence of Timing

Ileostomy Closure

Evidence surrounding timing of stoma closure is limited; however, there is some agreement among surgeons that stoma closure should occur no sooner than 60 to 90 days after sphincter-preserving proctectomy. This timing represents the "sweet spot" where patients have recovered from the primary surgery, intra-abdominal adhesions are more manageable, and stoma inflammation and edema have resolved.[5,6] Delaying stoma closure continues to expose patients to various stoma complications (up to 71%) including poor stoma site, dehydration, acute renal failure, need for parenteral nutrition, peristomal dermatitis, parastomal hernia, prolapse, retraction, and stenosis.[7] Conversely, complications of stoma closure may delay initiation of chemotherapy.

To evaluate timing of stoma closure following laparoscopic proctectomy for cancer, 259 patients were divided into three groups by time to stoma closure: <60, 60 to 90, and >90 days. Surgical morbidity rates increased with increased delay to closure (5 vs. 8 vs. 18%; $p = 0.03$), whereas anastomotic leak rates were significantly higher in the >90 day group (1 vs. 0 vs. 4 patients; $p = 0.03$). Length of stay was lower in the <60-day group (5 vs. 6 vs. 6 days; $p = 0.004$). Optimum results were obtained when stomas were closed before 90 days, even in patients undergoing chemotherapy.[5]

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A single-institution Swedish study examined their experience in timing of ileostomy reversal after proctectomy including the reason for delaying ileostomy closure. In total, 106 (79%) patients underwent stoma reversal with 19% of patients undergoing surgery within 4 months of low anterior resection, while 81% were delayed more than 4 months. Reasons for delay included low medical priority of stoma closure (58%), nonsurgical complications (20%), symptomatic anastomotic leak (12%), and postoperative chemotherapy (10%). Risk factors for a diverting ileostomy becoming a permanent ileostomy were stage IV cancer ($p < 0.001$) and symptomatic anastomotic leak ($p < 0.001$).[8]

A few small studies have evaluated the feasibility of early ileostomy closure within 10 days of the index operation in patients with an uncomplicated postoperative course. In a study of 93 patients, 19 underwent early ileostomy closure with 6 (32%) wound infections compared with 5 (7%) in the traditional timing group ($p = 0.01$). Early ileostomy closure was associated with shower median length of stay (14 vs. 17 days; $p < 0.05$).[9] Another group evaluated 27 patients, 9 of whom (33%) had postoperative complications and underwent delayed closure, and 18 (66%) who had early loop ileostomy closure at mean of 11 days (range: 7–21) after the initial procedure. The early stoma closure cohort had only minor complications such as wound infection ($n = 2$), intravenous catheter-related sepsis ($n = 1$), and small bowel obstruction ($n = 1$).[10] These studies have demonstrated feasibility of early stoma closure in a highly selected patient population; however, the results are controversial and this approach is not routinely suggested.

Hartmann's Reversal

Timing of Hartmann's reversal is debated. Adhesiolysis is the most significant challenge in laparoscopic Hartmann's reversal and the most frequent reason for converting to an open procedure. Although several authors report only mild adhesions at 3 months following Hartmann's procedure,[11–13] others suggest delaying reversal by 3 months[11,14,15] and several authors recommend waiting 6 months to allow for adhesion density to decrease and pelvic inflammation to resolve.[12,16]

Failure to Reverse

Despite initial intentions, the reality is that some temporary diverting stomas become permanent stomas for 6 to 32% of patients. Risk factors for nonclosure of diverting ileostomy include advanced age, anastomotic leak, metastatic disease, and adjuvant chemotherapy.[17–21] Only half of patients undergoing a Hartmann's procedure will ever undergo reversal, and this is consistent with the increased morbidity associated with Hartmann's reversal.[20,22]

Preoperative Evaluation

Contrast Enema

Evaluation of anastomotic integrity prior to ileostomy closure is essential, although there is no clear consensus on the best evaluation modality. A water-soluble contrast enema, is frequently used to evaluate anastomotic integrity. Contrast enema has been shown to have high specificity (95.4%) and negative predictive value of 98.4%, but moderate sensitivity (79.9%) and positive predictive value (64.6%) in the detection of clinically significant anastomotic problems. Digital rectal examination is also highly correlated with contrast enema findings (96.7%); therefore, in asymptomatic patients, Habib et al suggested contrast enemas may not be a necessary adjunct to clinical examination in patients with a low uncomplicated anastomosis.[23] Similarly, a single-center retrospective review of 81 patients with low rectal cancer who underwent low anterior resection with diverting stoma reported a 3.7% anastomotic leak rate and a 5.8% subclinical leak rate on contrast enema. Because the overall leak rate is low, the authors argue against the routine use of contrast enema for preoperative evaluation prior to stoma reversal. Instead, the authors recommend that contrast enema be used to confirm suspicion of anastomotic leak.[24] Kalady et al also reported a 4% anastomotic leak rate in 211 patients with temporary loop ileostomies created to protect coloanal/colorectal anastomoses or ileal pouch–anal anastomoses. No leaks or anastomotic strictures were identified on contrast enema that had not already been suspected clinically.[25]

Clinical Examination

Digital rectal examination is also a useful adjunct to identify anastomotic disruption, stricture, or obstruction and should routinely be performed along with endoscopic evaluation of the anastomosis prior to ileostomy closure. A prospective cohort study compared digital rectal examination and water-soluble contrast enema findings at 3 to 6 weeks postoperatively in 129 patients with coloanal/colorectal anastomosis or ileal pouch–anal anastomosis. They reported a 6.4% false-positive rate (normal digital rectal examination with abnormal contrast enema) and a 3.5% false-negative rate (normal contrast enema with obviously abnormal digital rectal examination). The sensitivity of digital rectal examination in detection of anastomotic pathology is 98.4%, and in experienced hands, it may yield more useful clinical information than a contrast enema.[26] Similarly, in a retrospective review of 95 patients, Larsson et al reported that contrast enema does not provide additional information if proctoscopy and digital rectal examination are normal.[27]

Persistent Anastomotic Leak

Some anastomotic leaks never resolve completely and result in a persistent anastomotic sinus, which can be seen on contrast enema. A small case series of 8 patients with persistent anastomotic sinuses revealed that sinus tracts that persist for longer than 1 year are unlikely to heal. While patients with subclinical anastomotic sinuses underwent successful stoma closure, patients with symptomatic persistent anastomotic sinuses associated with a cavity may not be suitable for reversal.[28] A posterior midline sinus identified on contrast enema can be laid-open with electrocautery or a laparoscopic linear cutting stapler to divide the luminal-cavity septum and allow drainage of the cavity. This

technique may facilitate healing of a persistent anastomotic sinus by secondary intention prior to stoma closure.[29] Seo et al suggested that ileostomy closure may be considered despite radiographic evidence of anastomotic leakage in select patients. In a review of 163 patients who underwent low anterior resection with diverting loop ileostomy, 11 of 16 patients with a persistent anastomotic leak on contrast enema went on to stoma closure and 2 (19%) of these patients had postoperative anastomotic complications. The authors suggest that morphological patterns of leakage on contrast enema may influence patient selection for ileostomy closure despite radiographic evidence of leakage.[30] However, the authors prefer to make all efforts to ensure sinus closure prior to stoma reversal. Options include curettage, fibrin glue instillation, and advancement techniques.

Technical Considerations

Hand-Sewn versus Stapled Anastomosis

The anastomosis in loop ileostomy closure can be performed using a stapled technique or a hand-sewn technique. The stapled technique allows for larger anastomosis, which is particularly useful as the defunctionalized limb is often narrow after a period of disuse. Because of the larger anastomosis, the rate of early postoperative small bowel obstruction is decreased in patients with stapled anastomosis. Though the cost of using the stapled technique may be higher, these costs are offset by the shorter operative times and shorter hospital stays.[31] In a meta-analysis of 4,508 patients who underwent loop ileostomy closure, 1,372 of whom had a stapled anastomosis and 3,129 of whom had a hand-sewn anastomosis, no difference was reported in risk of anastomotic leak (odds ratio [OR]: 1.37; 95% confidence interval [CI]: 0.81–2.29; $p = 0.24$). Patients undergoing stapled anastomoses had shorter operative times (by 11.5 minutes; $p = 0.02$), faster return of bowel function (by 0.5 days; $p < 0.001$), shorter length of stay (by 0.7 days; $p = 0.03$), and lower rates of conservatively managed small bowel obstructions/ileus at 30 days when compared with the hand-sewn group (OR: 2.27; 95% CI: 1.59–2.96; $p < 0.001$).[31] Other studies have reported similar results including decreased rates of bowel obstruction, shorter length of stay, and shorter operative times with stapled anastomosis with similar rates of anastomotic leak.[32,33] A recent retrospective review from a prospectively maintained database of 350 side-to-side functional end-to-end stoma closures found a significantly more rapid resolution of ileus after a 100-mm linear stapler was used as compared with shorter stapler lengths.[34]

Wound Management

Surgical site infections are frequent complications following stoma reversal and are reported occur in 2 to 41% of patients.[35–37] Wound infection after stoma closure can have significant ramifications such as wound dehiscence, incisional hernia, longer hospital stays, and increased hospital costs. A 2011 analysis estimated a per-patient hospital cost of an episode of surgical site infection was US$2,600 with an additional US$6,200 for postdischarge care.[38] In a review of 128 patients who underwent stoma reversal, 46 (36%) had a surgical site infection. The authors identified several factors significantly associated with surgical site infection including fascial dehiscence (OR: 16.9; 95% CI: 1.94–387), colostomy (OR: 5.07; CI: 2.12–13.0), thicker subcutaneous fat (OR: 2.02; 95% CI: 1.33–3.21), and black race (0.35; 0.13–0.86). Patients without any of these risk factors had a 0% risk of surgical site infection, whereas patients with all four factors had a 100% risk of surgical site infection.[39] A systematic review of 1,613 patients evaluating incisional hernia either at midline or at the stoma site following stoma reversal identified a median of 8.3% for stoma site incisional hernia and 44.1% for midline incisional hernia.[40]

Several strategies have been suggested to decrease the risk of wound infection, including delayed primary closure, secondary closure, iodine wound irrigation, closure over a drain, and purse–string closure.[36,41] Of these techniques, purse–string closure and primary closure are most commonly performed and reported in the literature. Following fascial closure with 0 or 2–0 absorbable braided suture or 0 absorbable monofilament, a circumferential subcutaneous purse–string closure can be performed with 0 or 2–0 nonabsorbable monofilament suture or a 2–0 absorbable monofilament. The recommended diameter of the resultant defect is 5 mm.[36] Purse–string closures are loosely packed with iodine-soaked gauze, which was removed at 48 hours, and then covered with dry gauze dressing.[35] Nonabsorbable sutures are removed 8 to 10 days postoperatively.[35] Primary closure can be performed with interrupted 2–0 nonabsorbable monofilament or 3–0 absorbable monofilament suture, or a stapled closure.[41]

A recent meta-analysis including four randomized controlled trials and 319 patients compared purse–string closure ($n = 162$) to primary closure ($n = 157$). The purse–string closure group had a decreased surgical site infection rate (risk difference: –0.25; 95% CI: –0.36 to -0.15; $p < 0.00001$) and improved satisfaction with cosmesis (standard mean difference: 0.7; 95% CI: 0.13–1.27; $p = 0.02$) when compared with primary closure.[41] Similar results were obtained in a recent randomized controlled trial including 121 patients randomized to purse–string closure ($n = 61$) or primary closure ($n = 60$) after stoma reversal demonstrated decreased wound infection rates with purse–string closure when compared with primary closure (1.6 vs. 10%; $p = 0.061$) and improved patient satisfaction scores (25 vs. 24; $p = 0.012$). Furthermore, outcomes were not significantly different between ileostomy and colostomy patients.[35] A smaller nonrandomized trial of 48 patients comparing purse–string closure to primary closure also found decreased surgical site infection rates (0 vs. 21.4%; $p < 0.021$) and more satisfaction with scar ($p = 0.043$) when compared with the primary closure technique. This study, however, revealed longer time to complete healing with the purse–string technique (32 vs. 19 days; $p < 0.0001$) when compared with primary closure.[42] Data have repeatedly suggested that purse–string closure of the stoma closure site results in lower surgical site infections and improved patient satisfaction when compared with primary closure.[35,36,41–45]

Hartmann's Reversal

Hartmann's procedure has long been the treatment of choice for perforated diverticulitis. More recently, there has been a trend toward primary anastomosis with diverting stoma, particularly in patients with less peritoneal contamination. Perioperative morbidity, mortality, sepsis, and wound complications have been shown to be similar in a Hartmann's procedure versus primary anastomosis with diverting stoma despite higher acuity among patients with Hartmann's procedure.[46] Because Hartmann's reversal has a 55% overall complication rate compared with a 20% complication rate for ileostomy closure,[4] primary anastomosis with a diverting stoma is an attractive alternative.

In an analysis of 98 patients with perforated diverticulitis, 72 underwent Hartmann's procedure and 26 underwent primary anastomosis with diverting stoma. Hinchey classification was the significantly higher in patients with Hartmann's procedure. The leak rate with primary anastomosis was 8%. Reversal rates were significantly higher for primary anastomosis with diverting stoma (85 vs. 58%; $p = 0.046$). The median time to stoma reversal was longer for patients who underwent a Hartmann's procedure (19 vs. 12 weeks; $p = 0.03$). Duration of stoma closure procedure was also longer in Hartmann's procedure reversal when compared with diverting stoma reversal (140 vs. 49 minutes; $p < 0.001$). While patients with diverting stoma and primary anastomosis were reversed more often, sooner, and in a shorter time than those with Hartmann's procedure, significant selection bias limits broad application of study findings.[47]

Open versus Laparoscopic Techniques

As minimally invasive techniques have evolved, they have been applied to increasingly complex colorectal procedures, including the Hartmann's reversal, with success demonstrated in several small series. A systematic review revealed that many of the advantages associated with minimally invasive colorectal surgery, including decreased morbidity, shorter length of stay, and faster recovery, demonstrated in colorectal surgery apply with laparoscopic-assisted Hartmann's reversal.[13,48] In a retrospective comparison of 107 patients who underwent laparoscopic or open Hartmann's reversal, the laparoscopic approach was associated with faster return of flatus (2.8 vs. 4.0 days; $p < 0.0001$) and bowel movement (4.2 vs. 5.6 days; $p = 0.002$), shorter length of stay (6.7 vs. 10.8 days; $p < 0.0001$), and decreased postoperative morbidity (14 vs. 31%; $p = 0.04$).[3] Laparoscopic Hartmann's reversal is a safe and feasible technique that is associated with significant advantages over an open approach, though conversion rates have been reported over 60%.[49]

Stoma Site Only

Two studies have presented small series of Hartmann's reversal performed through only the former stoma site incision. In this technique, the colostomy is returned into the abdominal cavity, and the rectal stump is mobilized either bluntly with the aid of a transanal dilator or under direct visualization by manipulating the stoma site. Both series have demonstrated feasibility of these techniques along with relatively short mean operative times (81 and 65 minutes, respectively).[50,51]

The Difficult Hartmann's Reversal

Hartmann's reversal, closure of a left-sided colostomy with restoration of colonic continuity between the proximal colon and rectal stump, can be a technically challenging procedure.[52] Difficulty may be encountered in three stages: adhesiolysis, identification of the rectal stump, and performing the anastomosis. Injury to bowel, bladder, ureters, iliac vessels, and presacral veins are all possible problems. Prior peritonitis and resultant adhesions complicate entry into the peritoneal cavity; thus, when using a laparoscopic approach, entry under direct visualization through the Hasson technique is recommended. Entry is gained in the periumbilical location or through the stoma site,[53] but can also be safely achieved in the left upper quadrant, lateral to the rectus sheath. After pneumoperitoneum is established, two additional trocars are placed, adhesions are lysed, and, if not previously done, the splenic flexure is mobilized. The end colostomy is mobilized and an anvil is secured with a purse–string suture in the proximal colon. Finally, the rectal stump is identified, dissected free of surrounding structures, and a circular transanal stapler is used to create an anastomosis.[54]

Several techniques have been described to help identify the rectal stump. Some authors recommend leaving a polypropylene suture on the rectal stump. Others advocate the use of flexible sigmoidoscopy and laparoscopic localization of the light to help identify the rectal stump. Transanal insertion of the stapling device has also been described. When the rectal stump is difficult to identify, the bladder can be filled with 300 mL of saline through a Foley catheter to aid in bladder identification and safe dissection of the rectal stump.[14,54] It is critical to anastomose the proximal segment to the rectum and not to the distal sigmoid colon. On occasion, a loop ileostomy may be created after completion of the colorectal anastomosis.

Conclusion

Both ileostomy and colostomy serve an important role in temporarily protecting anastomoses and minimizing peritoneal sepsis. Reversal of temporary stomas is associated with significant complications, which can be minimizing by optimizing timing of closure and evaluating anastomotic integrity prior to stoma closure. A variety of techniques have been described to limit the morbidity of ileostomy and colostomy reversal. Minimally invasive approaches are preferred as these methods can decrease postoperative morbidity and hasten recovery.

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