Ileostomy

Vikram B. Reddy | Walter E. Longo

Ileostomy is an intestinal stoma fashioned from the distal small intestine. Although the creation of an ileostomy can be the smallest part of a larger surgery, the stoma can have the most significant physical and psychosocial effect on a patient. Despite an eventual return to a prior quality of life and activity level, body image and sexual function do not change over time. A well-constructed ileostomy can be lifesaving with minimal adverse effect on the quality of life, when constructed after careful counseling of the patient, preoperative planning, excellent technique, and valuable postoperative enterostomal therapy. Even after a well-constructed ileostomy, recognition and prevention of postoperative dehydration due to fluid losses from the ileostomy requiring drastic fluid resuscitation were required. Similar fluid and electrolyte losses were noted by Cattell and Sachs, with the latter reporting a 33% mortality following an ileostomy. Despite the initial success, ileostomy creation was associated with significant morbidity due to the peristomal skin irritation from the small bowel effluent. Lahey later described the morbidity and the mortality associated with ileostomies.

Warren and McKittrick of Massachusetts General Hospital reported in 1951 on the outcome of 210 patients with ulcerative colitis managed by an ileostomy between 1930 and 1949. They coined ileostomy dysfunction and characterized it as “cramp-like pain and, paradoxically, increase in the volume of ileostomy discharge,” which in severe cases can lead to emesis and watery diarrhea with significant loss of fluids and electrolytes leading to a shocklike state. Unfortunately, these symptoms were noted in 62% of the patients. They also observed that early dysfunction was due to the peristaltic activity against the rigid abdominal wall, whereas late dysfunction was due to cicatrizizing granulation tissue on the serosa of exteriorized ileostomy. Symptomatic relief was achieved with catheter decompression, which was required in a third of all ileostomy patients and in more than half of all patients with ileostomy dysfunction.

Crile and Turnbull summarized ileostomy dysfunction as the sequelae of peritonitis of the protruding ileostomy that causes a functional obstruction. They noted spontaneous maturation over 4 to 6 weeks by eversion of the mucosa to the abdominal wall. Several procedures to combat the serositis, and thus ameliorate ileostomy dysfunction, were proposed: skin grafting the ileostomy as described by Dragstedt et al., fasciocutaneous grafting by Monroe and Olwin, and mucosal grafting by Turnbull and Crile. However, the most technically facile procedure was described by chance by Brooke of the University of Birmingham in 1952 and involved the evagination of the ileal end and suturing of the mucosa to the skin. To this day, the so-called Brooke ileostomy remains the standard technique for constructing an ileostomy.

**INDICATIONS**

Although ileostomies were initially used after proctocolectomy (for ulcerative colitis and polyposis) or the relief of obstruction, their use has evolved over the years in numerous disease processes. Etiologies include functional, hemorrhagic, infectious, inflammatory, ischemic, malignant, or mechanical. Their indications are better described by their permanence: permanent, temporary, or protecting, as shown in Table 84.1.

**PERMANENT**

An end ileostomy is usually indicated in situations in which the disease process affects the entire colon and...
ABSTRACT
Ileostomy is an intestinal stoma fashioned from the distal small intestine. Although the creation of an ileostomy can be the smallest part of a larger surgery, the stoma can have the most significant physical and psychosocial effect on a patient. Despite an eventual return to a prior quality of life and activity level, body image and sexual function do not change over time. A well-constructed ileostomy can be lifesaving with minimal adverse effect on the quality of life, when constructed after careful counseling of the patient, preoperative planning, excellent technique, and valuable postoperative enterostomal therapy. Even after a well-constructed ileostomy, recognition and prevention of postoperative dehydration due to the liquid output is imperative to prevent pouching problems, electrolyte abnormalities, and even renal failure.

KEYWORDS
Ileostomy, Ileostomy indications, Ileostomy techniques, Ileostomy complications
TABLE 84.1 Indications for Ileostomy

<table>
<thead>
<tr>
<th>Type</th>
<th>Surgical Procedure and Disease Process</th>
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<tr>
<td>Permanent</td>
<td>Proctocolectomy with end ileostomy</td>
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<tr>
<td></td>
<td>• Crohn disease</td>
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<td></td>
<td>• Ulcerative colitis</td>
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<tr>
<td></td>
<td>• Polyposis (familial adenomatous polyposis, Lynch syndrome, etc.)</td>
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<td></td>
<td>Total colectomy or proctocolectomy with end ileostomy</td>
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<td>• Colonic dysmotility with poor anorectal function</td>
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<td></td>
<td>• Neurogenic bowel</td>
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<tr>
<td>Temporary</td>
<td>Colectomy with ileostomy</td>
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<td>• Crohn disease with subsequent ileorectal anastomosis</td>
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<td></td>
<td>• Ulcerative colitis as the first stage of ileal pouch anal anastomosis</td>
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<td></td>
<td>• Clostridium difficile colitis</td>
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<td></td>
<td>• Gastrointestinal hemorrhage</td>
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<td></td>
<td>Partial colectomy with ileostomy</td>
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<td></td>
<td>• Right colon perforation/obstruction in immunocompromised or morbidly ill</td>
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<td></td>
<td>• Ileocolonic ischemia</td>
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<tr>
<td>Diverting</td>
<td>Colorectal anastomosis</td>
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<td></td>
<td>• Low anastomosis</td>
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<td></td>
<td>• Radiation</td>
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<td></td>
<td>• High-risk patient</td>
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<td></td>
<td>Ileal pouch anal anastomosis</td>
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rectum or the functional status of a patient precludes an anastomosis. Currently, a permanent ileostomy is used in the management of severe proctitis due to ulcerative colitis or Crohn disease (especially with significant perianal disease), familial adenomatous polyposis (FAP), and functional disorders, such as colonic dysmotility (with poor anorectal function) and neurogenic bowel.

TEMPORARY

A functional end ileostomy is fashioned after a segmental or total colectomy for a disease process that spares the distal colon or rectum and allows for a delayed reestablishment of intestinal continuity. This is encountered in patients with fulminant or toxic Crohn colitis or ulcerative colitis, Clostridium difficile colitis, uncontrolled lower gastrointestinal bleeding without a clear source, ischemia involving the ileocolic pedicle, or malignant obstruction involving the ascending colon or small bowel in the setting of immunosuppression where an anastomosis may not be prudent.

DIVERTING

In some disease processes, a proximal diversion with a loop ileostomy may be necessary as the first of a series of staged interventions or for protection of a distal anastomosis. The role of diverting loop ileostomies have been extensively studied with low anastomoses in rectal cancer and with ileal pouch anal anastomoses.

Diverting loop ileostomies have been used to diminish the complications of a distal anastomotic leak, especially in the pelvis or in high-risk patients. In immuno-compromised or malnourished patients, anastomoses that can otherwise be safely performed may also need fecal diversion. Although fecal diversion with an ileostomy may not diminish the risk of an anastomotic leak, the septic complications are significantly diminished and may avoid reoperation.

Loop transverse colostomies were traditionally used for fecal diversion. This trend changed when Williams et al. performed a randomized controlled trial to compare the outcomes of a loop colostomy with a loop ileostomy and demonstrated that the incidence of prolapse, leakage, skin irritation, odor, and surgical site infection at the time of the ostomy closure were significantly lower with a loop ileostomy. Multiple other meta-analyses have confirmed the significantly lower incidence of prolapse with a loop ileostomy and lower chance of wound infection and hernia formation after closure of a loop ileostomy as opposed to a loop colostomy.

PHYSIOLOGY

In the absence of any intestinal disorders or resection, the small intestine is able to absorb most of the fluid that it is exposed to. Ninety percent of the nutrients and nearly 6 L of fluid are absorbed in the jejunum while the ileum can absorb the remaining 2.5 L, leading to a concentrated effluent into the colon, where an additional 1.5 L are absorbed. The transport of water is passive and requires movement of solutes. The rate of water absorption in different portions of the intestine is a function of the solute absorption in that segment of the bowel. Sodium absorption is more complex and involves both active and passive transport. In the jejunum, sodium is transferred out of the lumen by cotransport with active uptake of both carbohydrates and amino acids, whereas it is actively transported against an electrochemical gradient in the ileum. Bicarbonate helps facilitate the active transport of sodium out of the lumen against the electrochemical gradient. Bicarbonate uptake in the jejunum is by active transport, whereas its trafficking in the ileum depends on the intraluminal concentration. The majority of chloride ions follow sodium transport passively down the electrochemical gradient. Potassium ion movement into the lumen is also passive down the electrochemical gradient.

Vitamin B12 and bile salts are absorbed in the terminal ileum. Without ileal reabsorption, hepatic synthesis of bile salts would not be sufficient for fat digestion. Lack of absorption of bile salts can lead to profound diarrhea by causing fluid and electrolyte secretion into the lumen and impairing colonic absorption of water and sodium. Serum vitamin B12 levels remain normal unless more than 100 cm of terminal ileum has been removed.

Interestingly, the ileum aids in slowing the transit and allows for absorption proximally. The transit time of the first 50% is one-third of the ileum. Consequently ileal resection can lead to shortened transit time and increased output, whereas resection of an equivalent segment of jejunum may not have an effect on transit time.

Ileostomy volume in the absence of proximal bowel loss can vary among individuals with output greater than 1.5 L, concerning for diarrhea and possibly fluid and
and a number next to it indicating the preference of the site. This should be covered with a translucent occlusive dressing. Alternatively, subcutaneous injection of methylene blue can be used to achieve a more permanent marking of the abdominal wall, although this is seldom needed.

After the patient has been anesthetized for the surgery, a 27-gauge needle can be used to mark the skin at the site of the “X” after removing the occlusive dressing.

**SURGICAL TECHNIQUE**

Creation of an ileostomy (Fig. 84.2), irrespective of the nature of the stoma, begins with mobilization of the selected segment of bowel to reach beyond the abdominal wall at the site of the stoma marking. Corresponding to the size of the bowel to be used for the stoma, a 1.5- to 2-cm circumferential incision is placed in the skin and extended through the subcutaneous tissues, down to the anterior rectus fascia. During open surgery, Kocher clamps are placed on the edge of the fascia to allow alignment of the layers of the abdominal wall during stoma creation. A vertical incision is then placed; the underlying rectus muscle fibers are visualized and split along the length of the fibers to expose the posterior rectus sheath. Care is taken to avoid any injury to the epigastric vessels, which, if unintentionally injured, can be ligated. A transverse incision is placed on the anterior rectus sheath to create a cruciate opening. The posterior rectus sheath and the underlying peritoneum are divided as one while avoiding any injury to the underlying bowel. In open surgery, a laparotomy pad can be placed underneath the peritoneum...
during its division, while in a laparoscopy, pneumoperitoneum can be maintained while entry is made into the abdominal cavity. The created hole should allow passage of two fingers. However, this may vary with the habitus of the patient and the edema of the bowel wall. A larger opening may lead to a parastomal hernia but may be preferable with edematous bowel or with hemodynamic instability. A tight opening may cause ischemia and obstruction of the ileostomy. At this point, the mobilized small bowel should be exteriorized and examined for viability and tension. Care should be taken to avoid twisting of the mesentery. If the mesentery is floppy and appears to twist around the luminal axis, it should be tacked to the anterior abdominal wall with absorbable sutures. Viability of the exteriorized bowel can be entertained by visualizing the pink serosa, palpating the pulsatile flow in the immediate vicinity, examining the viable mucosa of the stoma, or by trimming the ileostomy edge to confirm bleeding. After adequate length to avoid creation of a flat stoma has been ensured, the abdominal wall can be closed and the stoma can be matured depending on the type of ileostomy. Absorbable sutures are commonly used to mature the stoma, and bites should be placed in the subcuticular area rather than the epidermis to prevent ectopic mucosal implants at the suture sites on the dermis, which can lead to mucous production and break in the appliance-skin seal.

**END ILEOSTOMY**

An end ileostomy is technically the easiest small bowel stoma to create due to the mobility of the small bowel mesentery (Fig. 84.3). The mobilized, well-vascularized stapled end of the small bowel is everted through the abdominal wall while avoiding any twisting of the mesentery. Thick or bulky mesentery may need debulking to facilitate eversion. The staple line is completely removed. Three to four full-thickness sutures (depending on the peristomal fat) can be placed through the edge of the stoma, a more proximal seromuscular bite approximately 4 to 6 cm proximal to the edge, and into the subcuticular area of the skin opening (tripartite bites). After the sutures are placed, they can be tied to evert the ileostomy. Multiple other absorbable sutures can then be placed between the full-thickness edge of the ileostomy and the subcuticular layer to complete the mucocutaneous junction. Some surgeons prefer to not place any sutures in the seromuscular layer and are still able to evert the stoma without difficulty. The finished end ileostomy should protrude approximately 2 to 3 cm above the skin surface to increase the distance of the effluent egress from the skin-appliance interface, thereby diminishing leaks and peristomal skin irritation. Because most end ileostomies are often permanent or long term, care should be taken to avoid stomas that are flush or barely protrude above the skin because short ileostomies tend to leak ostomy effluent under the stoma flange and cause severe skin excoriation and weeping wounds with resultant pain and difficulty with pouching the stoma. 

**DIVERTING LOOP ILEOSTOMY**

A diverting loop ileostomy (Fig. 84.4) is typically used for fecal diversion after a proctectomy with ileoanal
Indications for a loop-end ileostomy include obese patient with a short mesentery or a thick abdominal wall, or conversion of a loop ileostomy to an end ileostomy (Fig. 84.6). The bowel is mobilized to the maximal extent possible, and the bowel is transected with a stapler. While the vascularity of the mobilized loop is maintained, a segment of bowel on the mobilized loop attaining the maximal elevation above the skin is selected. The orientation of the bowel and the mesentery is maintained similar to the technique of a loop ileostomy. The stoma is matured in a similar fashion to the loop ileostomy with the functional limb occupying most of the abdominal wall circumference. A support rod can also be placed under the bowel, and this can alleviate the tension at the mucocutaneous junction, which would otherwise be noted with an end ileostomy.

LAPAROSCOPY

Laparoscopic loop ileostomy was first described by Khoo et al. in 1993. The technique is similar to open surgery. After pneumoperitoneum has been attained and the resection, if needed, has been carried out, an abdominal wall opening is created at a preselected site. Often, a port can be placed at the preselected site, and this can be enlarged. A wound retractor is placed, and with the aid of a laparoscopic locking atraumatic bowel grasper, the selected loop of bowel is directed to the opening. A Babcock clamp is used to externalize the selected bowel while maintaining orientation and avoiding any twisting of the mesentery. The stoma is matured in a similar fashion to the loop ileostomy with the functional limb occupying most of the abdominal wall circumference. A support rod can also be placed under the bowel, and this can alleviate the tension at the mucocutaneous junction, which would otherwise be noted with an end ileostomy.

DIFFICULT ILEOSTOMY

Patient characteristics that predict a difficult ileostomy include obesity, emergency surgery, inflammatory bowel disease, or a history of multiple abdominal surgeries.
Intraoperatively, length and quality of the bowel and the associated mesentery dictates the ease of construction of an ileostomy. Elevated body mass index (BMI), large pannus, foreshortened or thickened mesentery (inflammatory bowel disease), mesenteric fibrosis, intraabdominal adhesions, or inflammation, and extent of the residual small bowel will have an impact on the ease of stoma creation.

The most common problem encountered in a difficult stoma is the reach of the terminal portion of the small bowel to and beyond the abdominal wall. The following maneuvers may be attempted to allow for reach:

**FIGURE 84.4** Loop ileostomy. (A) Exteriorization of a loop. (B) Placement of a bridge in the mesentery. (C) Incising the bowel. (D) Maturation of the limbs (simple for the defunctionalized limb, and tripartite for the functional Brooke ileostomy). (E) Completed loop ileostomy.
• Exteriorization of the mobilized bowel through a lubricated wound retractor (Alexis wound retractor, Applied Medical, Rancho Santa Margarita, California) to avoid any traction injury on the vasculature of the bowel or accidental trauma to the bowel wall.
• Incising the peritoneal lining of the mesentery perpendicular to the mesenteric vessels on both sides of the mesentery (Fig. 84.7). In a bulky mesentery, clearing the mesenteric fat while avoiding the vascular pedicles may provide a little more length.
• The stoma can be pedicled (Fig. 84.8) by dividing the arcade off the superior mesenteric artery while maintaining the collateral flow and the branches close to the wall of the bowel.
• Creation of an end-loop ileostomy as described before.
• A loop-end ileostomy may be advisable rather than a loop ileostomy. The mobilized bowel loop is delivered through the abdominal wall trephine, and the bowel is divided at the most mobile ileal site. The afferent limb is then matured in the usual fashion after dividing the mesentery. The efferent limb can be brought out through the same opening or through another smaller opening on the skin, and the antimesenteric portion of the staple line is removed, and this is sutured to the subcuticular area. If this is not feasible, the afferent limb can be left stapled off below the fascia as long as there is no risk of a distal obstruction.59
• Use of mesenteric support rods at the fascia. Usually support rods are placed in the mesenteric defect above the skin but, with a difficult ileostomy, may not prevent retraction or splitting the ileostomy. A mesenteric support rod can be placed below the subcutaneous tissues at the level of the anterior rectus sheath while maintaining the support rod exit sites lateral to the stoma appliance interface on the skin.
FIGURE 84.8 Loop ileostomy closure. (A) Taking down the mucocutaneous junction. (B) Handsewn closure. (C) Stapled side-to-side anastomosis. (D) Closure of the common channel. (E) Fascial closure.
POSTOPERATIVE CARE

A newly created ileostomy is often edematous and will shrink over the next 4 to 6 weeks. Initially, the stoma output is serosanguinous, lacks any particulate matter, and has been traditionally called bowel sweat. As the stoma starts to function, dark green bilious output is noted, and as the diet is advanced, particulate matter appears in the effluent. The exodus of the retained bowel contents from the postoperative ileus can lead to initial voluminous output, which slowly tapers over time. Dehydration is of concern in the early postoperative period and studies have shown readmission rates of 17% to 20%,62,63 with one study showing renal failure in 8.9%62 of those with ileostomies. Patient education, visiting nurse care, stoma output logs, and early follow-up have shown to decrease the incidence of readmissions for dehydration.51

Patient and caregiver education to manage the stoma and troubleshoot the appliance should be undertaken as soon as possible in the postoperative period. However, most ostomates are only able to empty their appliances at the time of discharge and will require education and troubleshooting with assistance from visiting nurse care. Postoperative education is crucial to care for the stoma, troubleshoot problems with the stoma and the appliance, and improve quality of life with the stoma. Enlisting a Wound, Ostomy and Continence Nurses (WOCN)-certified nurse to assist in the perioperative care of the patient will decrease ostomy-related distress and improve quality of life.51 Over the long term, periodic consultation with an enterostomal therapist and attendance at support groups will improve the quality of life of the patients.

COMPLICATIONS

Complications from the construction of an ileostomy can be numerous, as was described by numerous authors in the surgical evolution of stoma formation. Complications in ileostomy patients can be noted in more than 70%.64 Stoma height (<2 cm), female gender, advanced BMI, young age, loop ileostomy, malignancy, and emergent surgery have been associated with increase in postoperative complications.52 They can be classified as early (within 30 days) or late. Most early complications are due to technical issues with the construction of the ileostomy that can result in peristomal skin irritation, ischemia, retraction, or mucocutaneous separation. Unfortunately, significant diarrhea despite a perfectly constructed ileostomy is often prevalent (20%) in the early postoperative period. Prolapse, stenosis, and parastomal hernia are late complications, which often require operative revision.

The primary determinant of output is the length and quality of the bowel proximal to the stoma, rather than the amount of bowel resected. Clinically significant diarrhea is noted in up to 20% of patients.65 The highest risk is seen in the first week when the patients are still not able to match the stoma output with fluid intake and small bowel adaption has not completed. Removal of smaller segments of bowel over a long period of time has less impact on output rather than resection of an equivalent length at one sitting. Diarrhea associated with limited ileal resection, even up to 100 cm, is secretory with minimal nutritional losses rather than the osmotic diarrhea noted with greater resection (and resultant decreased fat reabsorption due to disruption of the enterohepatic circulation).66 Increased gastric acid secretion may contribute to increased ileostomy output, and proton pump inhibitors can play a role in decreasing the volume output in patients with extensive small bowel resection.67 This effect is mediated by the lack of peptide YY, which acts as an intestinal brake, especially in patients with extensive bowel resection.68

Antimotility agents, fiber supplements, bile acid–binding agents, and intravenous hydration with appropriate electrolytes may be needed to counter the fluid losses and to decrease transit times (Table 84.2).59–71

Peristomal skin irritation, especially in the immediate postoperative period, is the most common complaint.72 Up to 70% of new ileostomates have unrecognized peristomal skin irritation.73 Most of the peristomal complications are due to ill-fitting appliances or a large aperture on the flange that allows the ileal effluent to contact the skin. This irritated peristomal skin then weeps exudative fluid, which in turn weakens the seal with ostomy appliance and causes more skin irritation. To compound this further, leakage also causes more frequent appliance changes, which further disrupts the already damaged skin, setting up a vicious cycle. Consultation with an enterostomal therapist for appraisal of the type of appliance and aperture on the flange is necessary.

Care should be taken to fit the stoma flange aperture to the mucocutaneous junction. The peristomal skin should be protected with skin barrier wipes. If weeping skin is encountered, stoma powder or nystatin powder

<table>
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<th>TABLE 84.2 Causes of High Output</th>
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<tr>
<td>Extensive resection</td>
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<tr>
<td>Discontinuation of steroids, narcotics, and antimotility agents</td>
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<td>Crohn disease</td>
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<td>Stricture</td>
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<tr>
<td>Intestinal ischemia</td>
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<tr>
<td>Stricture</td>
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<td>Infectious enteritis</td>
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<td>Radiation enteritis</td>
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<tr>
<td>Bacterial overgrowth</td>
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<td>Food intolerance</td>
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<tr>
<td>Dietary indiscretion</td>
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<td>Anxiety</td>
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should be used. If a retracted or flat stoma is noted, a convex pouching system may be indicated. Peristomal contour abnormalities should be caulked with stoma paste to prevent any leakage underneath the flange. If peristomal satellite lesions are noted under the area of the appliance flange, fungal infections should be suspected. Topical nystatin powder is applied, excess powder is brushed off, and an adhesive barrier is applied followed by placement of the stoma appliance.

Ischemia of the ileostomy is suspected when the mucosa of the newly matured ileostomy appears dusky. Its incidence ranges from 1% to 21%.\(^6^4,7^5–7^7\) Causes include poor vascular supply or a small abdominal wall opening that can lead to congestion and compression of the vasculature supplying the ileostomy. Loop ileostomies, with their preserved arcades and collateral flow across an intact and undivided mesentery, are less prone to arterial insufficiency. Palpation of the arterial flow in the mesentery, bleeding from the edge of small bowel, and mucosal evaluation are paramount to prevent stomal ischemia. Frequently the distal edge of the stoma, which is the segment most susceptible to ischemia, will show mucosal changes and, with time, can even show demarcation where the vascular supply is tenuous. Usually the mesentery can be trimmed to the bowel edge for 2 to 5 cm without any decreased perfusion of the mucosa.\(^7^6\) Trimming the bowel to the area of the demarcation can minimize the need for a future stoma revision. If an adequately vascularized segment of bowel is exteriorized, and the stoma becomes ischemic, venous engorgement should be suspected. The opening in the wall may need to be enlarged, and, if this is not feasible, the mesenteric fat may need debulking to allow venous dilation.

The extent of ischemia can be variable, and scoring the mucosa with a needle to assess for perfusion facilitates assessment or preferably by shining light through a lubricated test tube placed in the os of the stoma. Stomal ischemia is suspected when changes are noted in the mucosa: they can vary from pallor to petechiae to dusky and almost gray necrosis. With mild ischemia, the mucosal surface can slough, but the deeper layers will be viable, and this can be observed without the need for reintervention. If the ischemia extends below the fascia, exploration and revision of the ileostomy is needed to prevent progression to intraabdominal perforation.\(^7^9\) If the ischemia is confined to the bowel above the fascia and a permanent ileostomy was fashioned, revision should be entertained depending on the patient’s clinical condition because distal ischemia can lead to necrosis and a flat stoma that may be difficult to pouch. Oftentimes, as the edema decreases and the abdominal wall opening stretches, mild ischemia can resolve. In conservatively managed mucosal ischemia, a fibrotic ring of the mucocutaneous junction can develop with eventual stenosis that will need revision.

Retraction of the stoma is another late consequence of ischemia. This can occur with separation of the mucosa from the skin surface. Most common etiologies include tension at the anastomosis or use of diseased bowel for the maturation of the stoma. Operative intervention is not needed, and it can be managed by covering the separation with stoma adhesive powder and placing the appliance on top. The separation heals by secondary intention and will eventually lead to stenosis. Stoma retraction has been previously defined as a stoma that is 0.5 cm or more below the skin surface, usually due to tension.\(^7^7\) Late retraction is usually due to an ischemic insult. Retraction in the early postoperative phase, even in a well-constructed ileostomy, can be noted in obese patients due to an inadequately mobilized stoma with a large hanging pannus.

Obstruction can be mechanical or functional. Mechanical causes include obstruction due to a tight abdominal aperture, twisting around the mesenteric axis, or a misplaced stitch during maturation. Postoperative ileus is the most common cause of early functional obstruction. In the presence of an ileus, the stoma output can be green or yellow, watery fluid with no odor or gas. The other symptoms of ileus may also be present. Distinguishing between the two etiologies of obstruction will need an ileoscopy or a retrograde contrast study via the stoma. Although mechanical causes will need operative intervention, ileus can be managed expectantly and should eventually resolve.

Peristomal abscess, which presents due to contamination at the time of the ostomy formation or due to a fistula, presents with surrounding erythema, warmth, and increasing tenderness in the vicinity of the peristomal skin. Management involves drainage of the collection at a site that will not interfere with the pouching or at the mucocutaneous junction. Common causes of a fistula include Crohn disease, unrecognized suprafascial enterotomy during stoma formation, or accidental incorporation of the dermis when placing the tripartite sutures during the eversion of the ileostomy. Rarely, an intraabdominal process can present as a fistula or peristomal abscess, and these will need operative management. Late peristomal abscess should raise the suspicion of underlying Crohn disease.

**LATE COMPLICATIONS**

Late complications are more prone to occur after the patient has recovered from the initial surgery and has become quite familiar with the everyday life of their ileostomy. Involving these patients with an enterostomal therapist in a dedicated enterostomal therapy clinic with regularly scheduled visits can be very rewarding for the patient and ameliorate some of these patients’ anxiety when complications occur and thereby improve the outcome and quality of life. These late complications generally bother patients with permanent ileostomies because most temporary stomas are reversed within 3 to 6 months. Late complications include bleeding, stoma prolapse and retraction, stenosis, small bowel obstruction, and parastomal hernia.

Lower gastrointestinal bleeding manifested by blood in the ileostomy bag is rarely a complication unless it is a result of preexisting inflammatory bowel disease or bleeding from the foregut. Such entities as bleeding from small bowel diverticulosis, arteriovenous malformations, or small bowel tumors must always be considered. That being said, major bleeding from the stoma exclusive of the aforementioned causes remains uncommon. There is a subset of patients with advanced liver disease and portal hypertension who are prone to develop stomal varices.\(^8^0\) This may specifically be seen in patients with...
ulcerative colitis in the setting of primary sclerosing cholangitis and in alcoholic cirrhosis. These stomal varices remain a challenge to manage. Local treatment using mucocutaneous separation or ligation may be effective; however, transjugular intrahepatic portosystemic shunting at times is often required.\textsuperscript{1–8} Not uncommonly encountered is bleeding secondary to excoriation from the mucocutaneous junction secondary to inadequate pouching. This presents as bright red blood per os. This is easily diagnosed and treated in conjunction with the enterostomal therapist.

Ileostomy prolapse occurs in approximately 5% to 10% of patients when reported but in reality is most likely underestimated. This can be an annoying complication that may be difficult to resolve. Complications from the prolapse, such as incarceration or strangulation, may occur in less than 10% of prolapsed stomas. Uncomplicated ileostomy prolapse can be managed conservatively with manual reduction or the use of osmotic agent facilitated by table sugar or even honey.\textsuperscript{84} In the setting of complicated prolapse with ischemia or incarceration that is unable to be reduced, the ileostomy requires surgery. This involves full-thickness resection of the prolapsed segment. This is accompanied by construction of the stoma at the original site.\textsuperscript{85}

Ileostomy stenosis is often due to a technical complication that has occurred early on with subsequent ischemia or mucocutaneous separation.\textsuperscript{85} This results in scarring and may pose difficulty in both evacuation and pouching and narrowing of the stoma sufficient to interfere with normal bowel function. Because the effluent from the ileostomy is liquid, intestinal obstruction is uncommon, unless the stenosis involves a segment of the ileum instead of stenosis only at the skin level. The patient should be evaluated for other causes of stenosis, such as primary or recurrent Crohn disease or malignancy. Dilution, either digital or endoscopic, may be entertained; however, care must be taken to avoid perforation. Simple revision is required in this setting, unless it extends to the fascial or subfascial level where a segmental bowel resection may be required. At times, enlargement of the skin opening is required. A local revision involving a Z-plasty can also be effective.\textsuperscript{86}

Parastomal herniation of an ileostomy is an extremely challenging problem for the patient and physician.\textsuperscript{87} Often your conduct at the initial operation when the stoma is created is your best opportunity to make all efforts to prevent this complication. Regardless, patient morbidty, such as obesity, diabetes, liver and pulmonary disease, chronic steroid usage, malnutrition, advanced cancer, and age, are some of the factors that predispose patients to this. Not all parastomal hernias require surgical repair. Asymptomatic patients need assurance, but at the same time, instruction on signs and symptoms of incarceration should be provided. Once again, involving the enterostomal therapist in their care is paramount. Abdominal binders and stoma belts may be worn to aid in promoting hernia reduction and appliance fitting. Surgical repair will be required in a small group of patients.\textsuperscript{88} Choice of surgical procedure depends on many factors. Procedures include repair by direct fascial reapproximation, local repair with prosthetic mesh, or stoma relocation. There should be a low threshold to involve plastic surgery when recurrent or complex parastomal hernias are present. One must be quite frank with patients and their families that recurrence rates approach 50%. An open or laparoscopic approach when feasible should be entertained. Mesh complications occur in a variable rate.

Small bowel obstruction in the setting of an ileostomy will occur just as in any patient who has had previous abdominal or pelvic surgery. The etiologies of intestinal obstruction include adhesions, volvulus, internal hernia, recurrent Crohn disease, food bolus obstruction, and stomal stenosis. Patients will classically describe minimal to absent ileostomy output, distention, anorexia, and vomiting. Pain may be a presenting symptom and, when present, should alert the clinician to the possibility of threatened bowel and impending ischemia. The apertu re lends to advantages in diagnosis and therapeutics, such as ileoscopy and retrograde contrast enema. It is often advantageous to involve the enterostomal therapist in treatment because food impaction will respond to enemas and irrigations and dietary modifications, especially if recurrent. Intestinal obstruction in the setting of an ileostomy is managed similar to other bowel obstructions. Initial correction of dehydration and electrolyte abnormalities is paramount, followed by a detailed physical examination and diagnostic imaging, which currently is often a double-contrast computed tomography scan. In the absence of writhing pain and/ or peritonitis, nonoperative management is instituted, which may involve nasogastric decompression. After eliminating a bolus obstruction, failure to resolve the obstruction within a short period of time may require surgery. A minimally invasive approach, if possible, is preferred.

Other less common complications may also occur. Dermatitis can result in severely denuded skin due to the nature of the ileostomy effluent. With chronic irritation and wetness, acanthotic changes develop in the peristome skin. Allergy to pouching products should always be suspected and may require a change in the brand and type of appliance, along with topical steroids. Treatment, in conjunction with an enterostomal therapist, involves correction of causative factors, skin barriers, and antifungals.

Peristomal pyoderma gangrenosum (characterized by painful ulcers with violaceous undermining borders and thin bridges of epidermis bridging the ulcer) can be seen at the stoma site in patients with inflammatory bowel disease. It is often associated with female gender, obesity, and inflammatory bowel disease.\textsuperscript{89,90} At times difficult to diagnose because of inadvertent suspicion of other entities such as contact dermatitis, extension of Crohn disease, or stitch abscess, these lesions are best managed by systemic, intradermal or topical antiinflammatory agents, including steroids\textsuperscript{91} and tacrolimus.\textsuperscript{92,93} Pyoderma parallels inflammatory bowel disease activity, and use of immunomodulators and biologics have been associated with resolution. Ultimately, stoma repositioning may be needed for managing refractory pyoderma, but relocation cannot guarantee against recurrence at the new stoma site.

Adenocarcinoma arising in an ileostomy has been described.\textsuperscript{94–99} Etiology can be chronic irritation or association with inflammatory bowel disease. Unfortunately, it
is often diagnosed late. Treatment is similar to other instances of adenocarcinoma of the small intestine and involves resection and preferably resecting of the stoma.

**ILEOSTOMY CLOSURE**

A loop ileostomy is generally closed 2 to 3 months after its creation, provided remission of distal pathology or adequate healing of a distal anastomosis is established. Studies have suggested the possibility of closure within 2 weeks of the creation. The initial study showed that two-thirds of patients could have their ileostomies closed during the same admission as their index surgery without any increase in complications. Since then, other studies have confirmed the low morbidity of an early closure. A multicenter randomized controlled trial showed the safety of closure within 2 weeks as opposed to 12 weeks.

In the setting of chemotherapy, closure can be undertaken a month after completion of therapy. Ileostomy closure is generally not advisable prior to or during chemotherapy to mitigate any delay in therapy should a complication arises as a result of the stoma closure.

Prior to the closure of a loop ileostomy, a water-soluble contrast enema study is used to assess the bowel distal to the ileostomy for any structural abnormalities or anastomotic leak. Due to the liquid effluent from the ileostomy, most patients may not need a bowel preparation prior to the ileostomy closure. In a majority of the cases, the loop ileostomy takedown can be achieved with a circumferential incision placed approximately 1 to 2 mm from the mucocutaneous edge. Both limbs of the ileostomy are then dissected free off the subcutaneous tissues and the fascial edges and prolapsed out of the abdominal cavity. Only in a few selective cases, where prohibitive adhesions are encountered, should the takedown be undertaken with a midline laparotomy. Any serosal tears encountered, especially to the fascial edges or the rectus muscle, should be addressed immediately to prevent their progression to enterotomies due to retraction. Any occult enterotomies can be ascertained by insufflating the bowel loops with povidone-iodine (Betadine) solution. The loop ileostomy can be closed by apposing the antimesenteric edges of the ileostomy or by a side-to-side anastomosis, which can be fashioned either hand sewn or stapled. No differences in outcomes have been noted with either technique, and individual surgeon preference and comfort should dictate the operative approach. After the anastomosis has been fashioned and reduced into the abdominal cavity, the fascia is approximated. The subcutaneous tissues are irrigated and approximated to decrease the dead space. The skin can be partially reapproximated. Several approaches to skin closure have been described.

**REFERENCES**


