More than one million individuals in the United States and Canada live with some type of intestinal stoma. These stomas are typically constructed as one of the last components of a long and challenging surgical procedure. Although created in only a few short minutes, permanent stomas must function for the remainder of the ostomate’s lifetime.

The creation of a stoma is a technical exercise. Like most undertakings, if done correctly, the stoma will usually function well with minimal complications for the remainder of the ostomate’s life. Conversely, if created poorly, stoma complications are common and can lead to years of misery. Intestinal stomas are in fact enterocutaneous anastomoses and all the principles that apply to creation of any anastomosis (i.e., using healthy intestine, avoiding ischemia and undue tension) are important in stoma creation.

**INDICATIONS**

Stomas are created either as a temporary means of fecal diversion when an anastomosis is unsafe or unwise, or as permanent orifices for the passage of excrement (stool or urine) when surgical resection prohibits the body’s normal orifices from accomplishing these tasks. In this chapter, we will discuss the creation of ileostomies and colostomies.

Permanent colostomies are nearly always created from the sigmoid or descending colon, usually in association with distal bowel resection. Colostomies proximal to the splenic flexure typically function poorly, are often placed in locations difficult for ostomates to manage, and are at high risk for complications. If a permanent colostomy is contemplated using the transverse or ascending colon, the surgeon should strongly consider resecting the remaining large bowel and creating an end ileostomy. Common indications for a colostomy are listed in Box 179-1.

With the development and general acceptance of the ileal pouch–anal anastomosis (IPAA), permanent ileostomies are far less common than they were 25 years ago. Nonetheless, permanent ileostomies are often created for inflammatory bowel disease, familial adenomatous polyposis, multiple synchronous colorectal cancers, and a variety of other miscellaneous disorders. Poor anal function, comorbid diseases, or quality of life considerations may make an ileostomy preferable to more complex reconstructive options in selected patients.

Temporary diverting stomas are usually created in association with distal bowel resections when anastomosis is unsafe or to protect a distal anastomosis when operative conditions or comorbidities make proximal diversion of the fecal stream prudent.

Traditionally, three types of diverting stomas predominate: end sigmoid colostomy, transverse loop colostomy, and loop ileostomy.

**PREOPERATIVE CONSIDERATIONS**

Patients undergoing either elective or emergency surgery in which the creation of an abdominal stoma is a possibility should be adequately prepared preoperatively. Emergent surgery dictates a more rapid preparation than elective surgery, but stoma considerations must not be neglected.

Many patients are unsure as to what a colostomy or ileostomy is. A few minutes of preoperative education by the surgeon combined with printed material is very helpful. In addition, if available, all patients should meet with an enterostomal therapist (ET). The ET can provide specific information regarding stoma appliances, dietary and clothing alterations, and pouch management. Most importantly, the ET will help select the appropriate abdominal wall site for the future stoma. Appropriate stoma placement decreases postoperative complications and may improve the ostomate’s well-being for years following surgery. Bass et al showed that preoperative counseling and marking by an ET prior to surgery improves postoperative quality of life.

In addition to meeting with an ET, patients scheduled for stomal surgery often benefit from the opportunity to meet with other ostomates. Prior patients now well adjusted to life with a stoma provide an excellent, “nonmedical” source of information and are often glad to share their experience with new ostomates. In addition, local chapters of the United Ostomy Association and the Crohn and Colitis Foundation may be of benefit in this area.

Patients should be marked prior to surgery. An abdominal surgeon should be able to locate and mark stoma sites. In most circumstances, marking is simple, straightforward, and only requires a few minutes. Three abdominal wall landmarks outline the “ostomy triangle” (Figure 179-1): The anterior superior iliac spine, the pubic tubercle, and the umbilicus. The stoma should lie within this triangle overlying the rectus muscle, generally at the site of an infraumbilical bulge in the abdominal wall. A site should be located on a flat segment of the abdominal wall 5 cm away from bony prominences, the umbilicus, prior surgical scars, or skin folds. Once the site has been selected and marked, the patient should sit up to ensure any new skin folds do not interfere with the stoma site. The patient’s beltline should be identified and avoided if possible as this decreases postoperative clothing restrictions.

Special circumstances may require additional consideration. In obese individuals, a large pannus may
The size of a quarter is removed sparing all subcutaneous fat, as this fat is helpful to support the stoma in the postoperative period. The fat is then separated with scissors or cautery to expose the anterior rectus sheath. The sheath is incised vertically with a curved Mayo scissors for 3 to 4 cm (Figure 179-3). The incision can then be extended in a cruciate fashion laterally for 1 cm if desired. Medial extension should be avoided as this brings the stoma incision in proximity with the midline incision and may make the midline closure more difficult. The rectus abdominis muscle is split in the direction of its fibers to expose the posterior sheath. With the nondominant hand protecting the underlying viscera, the posterior sheath is bluntly opened with the Mayo scissors and the defect is enlarged to admit two fingers (Figure 179-4).

After the abdominal wall defect has been created, the ileum is prepared. Any residual retroperitoneal attachments are divided to facilitate passage of the bowel through the abdominal wall without tension. The mesentery may be cleared from the terminal 5 to 6 cm of the ileum. Care is taken to leave a 1-cm strip of mesentery with the ileum, as this generally carries a vessel parallel to the ileal wall and will prevent stomal ischemia (Figure 179-5). The ileum is then oriented with the cut mesenteric edge cephalad and passed through the previously created defect in the abdominal wall. The ileum should protrude 5 to 6 cm beyond skin level and appear pink and well perfused. The lateral ileal gutter may be closed if desired to prevent small bowel obstruction secondary to small bowel rotating around the ileostomy. This is done by suturing the free edge of the ileal mesentery

**OPERATIVE TECHNIQUES**

**END ILEOSTOMY**

End ileostomies are routinely performed in association with either partial or total colorectal resections. Exposure is generally through a midline incision and the stoma is created after performing the indicated bowel resection. The premarked stoma site (usually in the right lower quadrant) is excised (Figure 179-2). A skin disc the size of a quarter is removed sparing all subcutaneous fat, as this fat is helpful to support the stoma in the postoperative period. The fat is then separated with scissors or cautery to expose the anterior rectus sheath. The sheath is incised vertically with a curved Mayo scissors for 3 to 4 cm (Figure 179-3). The incision can then be extended in a cruciate fashion laterally for 1 cm if desired. Medial extension should be avoided as this brings the stoma incision in proximity with the midline incision and may make the midline closure more difficult. The rectus abdominis muscle is split in the direction of its fibers to expose the posterior sheath. With the nondominant hand protecting the underlying viscera, the posterior sheath is bluntly opened with the Mayo scissors and the defect is enlarged to admit two fingers (Figure 179-4).

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**BOX 179-1** Common Indications for Permanent Colostomy

- Rectal cancer
- Radiation proctopathy
- Incontinence
- Refractory anorectal Infection
- Ischemia
- Crohn disease
- Diverticular disease
- Sacral decubitus

**FIGURE 179-1** The ostomy triangle is defined by the anterior superior iliac spine, the umbilicus, and the pubic tubercle on the right and left sides of the abdominal wall for ileostomy and colostomy placement, respectively.

**FIGURE 179-2** A disc of skin is excised at the stoma site.

**FIGURE 179-3** The fat is then separated with scissors or cautery to expose the anterior rectus sheath. The sheath is incised vertically with a curved Mayo scissors for 3 to 4 cm.
Colon, Rectum, and Anus

2250  SECTION IV  Colon, Rectum, and Anus

along the white line of Toldt until sufficient colon is mobilized to create a colostomy that protrudes from the abdominal wall and can be matured without tension. Once the colon has been sufficiently mobilized, the stoma site is prepared and the abdominal wall defect created similar to that described for end ileostomy. The only differences are that the premarked stoma site is usually in the lower left quadrant and the cutaneous and fascial openings may need to be slightly larger to facilitate unrestricted passage of the colon through the abdominal wall.

After the trephine site has been successfully created, the colon is oriented without twisting and passed through the abdominal wall. Again, the colon should protrude beyond the abdominal skin and appear well perfused. There is no need to close the lateral gutter or to suture the colon to the posterior abdominal fascia as neither of these maneuvers have been shown to prevent parastomal hernia or prolapse. Alternatively, a “retroperitoneal colostomy” can be created by tunneling the colon under the posterolateral peritoneum and exiting through the previously created stoma site. This has been associated with decreased rates of parastomal herniation and prolapse, but the increased technical demands with its creation have limited its utility.

Once the abdominal incision has been closed and protected, the colostomy can be matured. Colostomies may be sutured without eversion as distal colonic contents are not irritating to the surrounding skin.

**END COLOSTOMY**

As previously discussed, left-sided end colostomies are usually created in association with distal colorectal resection. The lateral attachments of the colon are transected along the white line of Toldt until sufficient colon is mobilized to create a colostomy that protrudes from the abdominal wall and can be matured without tension. Once the colon has been sufficiently mobilized, the stoma site is prepared and the abdominal wall defect created similar to that described for end ileostomy. The only differences are that the premarked stoma site is usually in the lower left quadrant and the cutaneous and fascial openings may need to be slightly larger to facilitate unrestricted passage of the colon through the abdominal wall.

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Once the abdominal incision has been closed and protected, the colostomy can be matured. Colostomies may be sutured without eversion as distal colonic contents are not irritating to the surrounding skin.
Meagher et al have devised a technique helpful in creating an end sigmoid colostomy in patients with a thick abdominal wall. The stoma site is created in standard fashion. A small wound protector (used in laparoscopic specimen extraction) is then inserted into the stoma trephine and opened maximally. The bowel is then passed through the wound protector. The inner ring of the wound protector is transected and removed. The remaining wound protector is brought out externally. The authors suggest this technique decreases spillage and minimizes bowel trauma during stoma exteriorization, particularly in the obese patient.2

DIVERTING STOMAS
As previously mentioned, diverting stomas are created to divert the fecal stream away from the “downstream” intestine. Diverting stomas consist of three types: loop ileostomy, loop colostomy, and end loop stomas. In the past, the most common loop stoma created was the transverse loop colostomy, popularized for the treatment of complicated diverticular disease and for protection of distal anastomoses. The transverse loop colostomy is often a poorly tolerated stoma with high complication rates and, therefore, has largely been replaced by the loop ileostomy. Additionally, anywhere a loop ileostomy or a loop colostomy is planned, an end loop ileostomy or end loop colostomy can be performed at the surgeon’s discretion.

LOOP ILEOSTOMY
The loop ileostomy is generally created in association with distal bowel resection. After the resection and/or anastomosis have been completed, a segment of terminal ileum is selected. The most distal segment of the terminal ileum that will reach the abdominal wall without tension is selected. This generally corresponds to a segment 20 to 30 cm proximal to the ileocecal valve or from an ileoanal reservoir. The ileum is encircled with a Penrose drain or umbilical tape after its mobility has been ensured.

An abdominal wall defect is created as previously described for an end ileostomy. The defect may need to be slightly larger to accommodate both loops of bowel, which, by necessity, pass through the abdominal wall in a loop stoma. Before passing the ileum through the abdominal wall, proper orientation is ensured and the
There are three types of end loop stomas: end loop ileostomy, end loop colostomy, and end loop ileocolostomy. These stomas have three main benefits: (1) they often make stoma management easier in the postoperative period as they appear very similar to end stomas, (2) they can be created with remote sections of the intestine, such as an end loop ileotransverse colostomy, and (3) they do not require formal laparotomy for stoma takedown. The end loop ileostomy and end loop colostomy can be created in any situation where a standard loop ileostomy or loop colostomy might be performed. End loop ileocolostomies can be created in association with intestinal resection. For example, a right colectomy may be performed for right colon trauma or for right colon ischemia and an anastomosis is deemed unwise. In this situation, the ileostomy and the transected edge of the proximal transverse colon can be brought through one single stoma site, avoiding the need for a second stoma and laparotomy at the time of stoma takedown.

**END LOOP ILEOSTOMY**

Following intestinal resection and creation of an appropriate abdominal wall defect, the end loop ileostomy is created as follows: A small defect is created in the mesentery at the preselected ileal stomal site. The midline incision is closed appropriately and protected with a cutaneous drape. The distal end is then matured with simple sutures between the full-thickness terminal bowel and dermis. These sutures are placed close to one another in order to “reserve” the majority of the stoma site for the functional, proximal stoma.

Once the distal end has been sewn to the abdominal skin, the proximal end is everted. Three “tripartite” bites are taken between the dermis, the seromuscular layer of the ileum 5 cm proximal to the transected end, and a full-thickness bite of the open end of the ileum. Once the three sutures have been placed, they are tied with gentle traction applied to an Allis clamp within the lumen to facilitate eversion. Maturation is completed with two additional sutures between the dermis and the full thickness of the terminal ileum (Figure 179-7). The loop stoma should protrude adequately, with its functional end occupying approximately 80% of the trephine circumference. Unless undue tension is present, a support rod is generally not necessary.

**LOOP COLOSTOMY**

A loop sigmoid colostomy may be created in order to prevent the fecal stream from reaching the rectum and anus in cases of incontinence, severe anorectal infection, or for proximal protection after complex anal reconstruction. This stoma is essentially created in identical fashion to that of a loop ileostomy with the exception that the stoma is commonly placed in the left lower quadrant. Eversion is not strictly necessary because of the noncaustic nature of the effluent from the left colon. However, in many circumstances, an end loop stoma as described in the following section is easier to create and functions better than the standard loop colostomy.3

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**END LOOP STOMAS**

**FIGURE 179-6** “Tripartite bites” between the dermis, the seromuscular layer of the bowel wall at the fascial level, and full thickness of the cut edge evert the stoma.
End Loop Colostomy
The end loop colostomy is created with a preselected segment of the sigmoid colon. It is mobilized appropriately and passed through the previously created abdominal wall defect similar to that of an end loop ileostomy. The abdominal incision is closed appropriately. The end colostomy is matured in a similar fashion to that of the end loop ileostomy. As previously mentioned for loop colostomies, the proximal end may be everted but a flush colostomy may also be created.

End Loop Ileocolostomy
This stoma can be performed in association with resection of the right colon when an anastomosis is unsafe. Following resection, the terminal ileum is prepared as for any routine end ileostomy. Often a stoma site will have to be created in the right upper quadrant in order to facilitate passage of the ileostomy and the distal transverse colon through the same abdominal aperture. Once the stoma site has been created, the terminal ileum is brought through the abdominal wall similar to an end ileostomy. The stapled-off end of the proximal transverse colon is brought through the abdominal wall defect. The mesenteric defect can be closed as with any standard colon resection.

Following this, the abdominal incision is closed in routine fashion. The antimesenteric corner of the transverse colon staple line is then transected and matured without eversion to the abdominal wall stoma site. Cutaneous sutures should be placed in proximity in order to save the majority of the stoma site for the ileostomy. Once this has been completed, the staple line is resected from the terminal ileum and the ileum matured as for a standard end ileostomy (Figure 179-9). The final suture between transverse colon and the ileum is placed to complete the maturation.

This stoma has the previously mentioned advantages of avoiding a second stoma site for a mucous fistula. In addition, because the terminal ileum and transverse colon are in close approximation through the same stoma site, stoma takedown can be later performed directly through a parastomal incision without the need for a formal laparotomy. This may significantly decrease subsequent morbidity and recovery time after the subsequent stoma takedown.

Laparoscopic Ileostomy
If an ileostomy is needed in conjunction with a laparoscopic bowel resection (protection of a low anastomosis) or an ileostomy alone is needed (diversion proximal to complex anovaginal fistula repair or anal canal reconstruction), it can be easily created laparoscopically. Principles that apply to open ileostomy creation also apply when the operation is performed laparoscopically. The site should be selected according to the patient’s body habitus and functional needs.

If a colectomy in conjunction with the ileostomy is essential, then ileostomy siting should be considered at the time of trochar placement. A trochar can certainly be placed through the future stoma trephine, but sites adjacent to the trephine within the footprint of the stoma appliance should be avoided. Trochars in place for the colectomy or proctectomy can be used to perform the intracorporeal components of the ileostomy creation.

If the ileostomy is created without any additional abdominal surgery, then only two ports are commonly necessary: one at the umbilicus for the camera and a second through the stoma site to manipulate the
creating an ileostomy from the distal limb is highly problematic for the patient [because it can lead to an unanticipated mechanical small bowel obstruction] and very embarrassing for the surgeon.) Once proper orientation is confirmed, the stoma can be matured in standard fashion. A loop, end-loop, or end ileostomy can be created as indicated based on the clinical setting. After completion of stoma maturation, pneumoperitoneum is reestablished, proper orientation is confirmed, and the abdominal cavity is checked for bleeding.

**Laparoscopic Colostomy**

Similar to ileostomy, all types of colostomies can be performed laparoscopically. Sigmoid colostomy is most common. Techniques are very similar to the creation of laparoscopic ileostomies. If trocars have been placed for rectosigmoid resection, no additional ports will be needed. If a colostomy is performed without other abdominal surgery, then three or four ports may be necessary. A camera port is placed through the umbilicus. Two ports are placed in the right midabdomen and the

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**FIGURE 179-8** Creation of an end loop ileostomy.
Some authors have advocated the use of carboxymethyl cellulose and sodium hyaluronate when creating temporary loop stomas in order to facilitate ostomy reversal. Very little is known about this, and it has not been subject to the rigors of a clinical trial. Authors suggest that wrapping the ileum at the time of stoma creation will minimize adhesions between the stoma and the abdominal wall, making stoma takedown easier. One study by Kawamura et al suggests shorter operative times in the antiadhesion group, whereas a similar study by Tang et al does not. The technique is described as follows. The loop selected is eviscerated and a large sheet of Seprafilm is cut in half. The proximal and distal limbs of the bowel and their adjacent mesentery are wrapped in a “sushi roll” style. After the barrier has adhered, the loop is brought through the abdominal wall at the preselected site and the stoma matured in standard fashion. The utility of this technique remains unproven, but minimizing adhesions between the ileum and the abdominal wall should, in concept, make dissection at the time of ileostomy takedown easier.

ENTEROSTOMAL THERAPY

A dedicated ET's contribution to the long-term quality of life of an ostomate is simply immeasurable. Such therapists provide preoperative counseling, early postoperative education and guidance, and act as a long-term resource for individuals with stomas. They supply information on appliance choices, local support groups such as the United Ostomy Association and the Crohn's and Colitis Foundation, suggest dietary or clothing modifications that may alleviate stoma-related problems, and aid in the management of skin problems, parastomal hernias, prolapse, and other complications. In most situations, an ET or surgical nurse will provide detailed postoperative education for a new ostomate. However, if this support is unavailable, it is the surgeon's responsibility to ensure the patient is educated in appliance management.

The appliance must be emptied frequently enough to avoid overfilling and dislodgement of the pouch. This is determined by the location of the stoma and the patient's natural bowel pattern. Ileostomies are usually emptied four to six times per day, with colostomies emptied once or twice per day or even once every other day. The entire appliance only needs to be changed every 4 to 7 days. The exact details vary from individual to individual, but a common technique for changing a typical one-piece system is explained in Box 179-2.

Pouches should generally be changed when the stoma is least active, which is often after a period of fasting. The time will vary from individual to individual, but changing the appliance when the stoma is less active avoids the need to control fresh output during the procedure.

The noise and odor of gas emitted from a stoma are a major concern to most ostomates. Anything that causes gas before creation of the stoma is likely to create gas following its construction. Gas comes from two sources: swallowed air and bacterial breakdown of ingested foodstuffs, particularly carbohydrates. The amount of


**BOX 179-2 Stoma Care**

1. Gather all supplies.
2. Gently remove soiled pouch by pushing down on skin while lifting up on pouch. Discard soiled pouch in odor-proof plastic bag. Save tail closure.
3. Clean stoma and peristomal skin with water; pat dry. If indicated, shave or clip peristomal hair.
4. Use stoma-measuring guide or established pattern to determine size of stoma. Presized pouch: Check to be sure pouch opening is correct size. Order new supplies if indicated. Cut-to-fit-pouch: Trace correctly sized pattern onto back of barrier or pouch surface and cut stomal opening to match pattern. Once stomal shrinkage is complete, this step may be omitted and preparation of the clean pouch may be completed before the soiled pouch is removed.
5. Apply skin barrier paste around the stoma. (Tip: wet finger to facilitate paste application.) An alternative approach is to apply skin barrier paste to the aperture in the prepared pouch or barrier. Allow paste to dry. Optional: Apply skin sealant to skin that will be covered by tape. Allow to dry.
6. Remove paper backing from pouch or barrier to expose adhesive surface; center pouch opening over stoma and press into place. Attach closure. Optional: Apply tape strips to “picture frame” the pouch-skin junction.


swallowed air can be minimized by avoiding the use of straws, excessive talking while eating, chewing gum, and smoking. Each individual can best identify which foods lead to gas production, but beans, broccoli, onions, brussel sprouts, beer, and dairy products in lactose-deficient individuals are common culprits. Avoiding these foods is a personal choice, but will decrease the quantity and odor of stomal flatus. Yogurt, parsley, and orange juice have been associated with decreased odor. Odor-proof pouches, charcoal filters, and pouch deodorants (such as commercial deodorants, mouthwash, and perineal deodorants) may also help. Orally ingested deodorants are also available and include bismuth subgallate and chlorophyllin complex. However, the most important key to preventing odor is good peristomal hygiene and creating a leak-proof seal at the time of appliance change.

A period of adjustment occurs in all ostomates, but attention to detail at the time of appliance change combined with minor dietary and clothing modifications should make a stoma completely unnoticeable to all except the ostomate’s closest acquaintances. In addition, abdominal stomas should not preclude participation in almost any physical activity.

**COMPLICATIONS**

Despite modest advances in surgical technique and enterostomal therapy, complications after stoma creation remain extremely common. The rate of stoma-specific complications in the literature varies quite widely, ranging from 10% to 70% depending on the methodology of the study, the length of followup, and the definition of a complication. For example, virtually all ostomates will have at least transient episodes of minor peristomal irritation, and skin irritation is often the most commonly reported stoma complication. Studies only reporting problems that require revisional surgery will obviously indicate a much lower rate of complications. As such, the relative incidence and frequency of the specific complications vary substantially from series to series.

Stoma-related complications may be classified as those that occur early (within 1 month of surgery) or late (more than 1 month postoperatively). The most common early complications are peristomal skin irritation, leakage, high output, and ischemia. The most commonly reported late complications include parastomal hernia, prolapse, obstruction, and stenosis.

**INCIDENCE**

There is no universally accepted criteria for what constitutes a “complication.” As such, adverse events associated with stoma creation may be quite mild, such as transient skin irritation or leakage, or require major revisional surgery as may be the case for parastomal hernia or necrosis. In a 20-year retrospective review of 1,616 patients in the Cook County Hospital database, Park et al reported a 34% incidence of complications, 28% being early and 6% classified as late. The most common early complications were skin irritation (12%), pain associated with poor stoma location (7%), and partial necrosis (5%). The most common late complications were also skin irritation (6%), prolapse (2%), and stenosis (2%). Of note, complications varied greatly by service, with ileostomies created by general surgeons associated with a 47% complication rate, whereas the complication rate for colorectal surgeons was 32%. Duchesne et al retrospectively reviewed 164 ostomates cared for at Charity Hospital in New Orleans. The overall complication rate was 25%; 38% of the complications were early and 62% were late. As is typically the case, ileostomies were associated with a higher complication rate than colostomies. The most common complications were necrosis (22%), prolapse (22%), skin irritation (17%), and stenosis (17%). Risk factors for complications included inflammatory bowel disease, ischemic colitis, and increased body mass index. As others have observed, obesity markedly increased the risk of skin irritation. Of particular note was the sixfold decrease in stoma complications when an ET was involved in the patient’s care.

Saghir et al retrospectively reviewed 121 stoma patients and reported a 67% complication rate, 41% of which were considered minor and 26% were considered major. Nine of the patients (7%) required revisional surgery. Complications were associated with older age, increased medical comorbidities, and an ostomy created by other than a colorectal surgeon.

Life table analyses have been performed both for patients undergoing ileostomies and colostomies. The cumulative probability of a complication after creation of an end ileostomy in 150 patients was 68% at 20 years. There was a 34% cumulative risk of skin problems, which tended to diminish over time. Twenty-three percent of patients developed a bowel obstruction. Of note in this
series, patients undergoing an ileostomy for ulcerative colitis had a higher risk of complications than those undergoing an ileostomy for Crohn disease. Most other studies find the opposite to be true. The actuarial risk of a colostomy complication was 58.1% at 13 years. The cumulative probability of revisional surgery was 17% at 11 years. The most common complications were hernia (37%), obstruction (14%), prolapse (12%), and stenosis (7%).

Both patient-specific and technical factors contribute to stoma complications. Preoperative consultation with an ET, or at least preoperative stoma marking, reduces the incidence of stoma-related complications.1

SKIN IRRITATION/LEAKAGE

Skin irritation is very common among patients with a stoma. In a review of 610 patients, it was by far the most common early local complication. The problem is far more commonly seen in patients with an ileostomy owing to the liquid, caustic effluent; this highlights the need for proper technique when an ileostomy is created. Nugent et al described the results of a study utilizing quality-of-life questionnaires in 391 ostomates. Fifteen percent reported problems with a “rash” and 36% had experienced leakage, both of which were much more commonly seen with ileostomies than colostomies. Thirty percent of patients with a colostomy and 55% with an ileostomy had experienced a reaction to the adhesive. However, only 8% of ostomates reported a substantial degree of difficulty associated with skin irritation.

Although a minor degree of skin irritation on occasion is probably inevitable, most significant cases of skin irritation are potentially preventable. Preoperative marking by an ET can help ensure proper siting and a secure fit. Appropriate location and careful appliance fitting minimize the noxious, irritating effect that can be associated with leakage or unprotected peristomal skin (Figure 179-10). Patients also need to be monitored for allergic reactions to the components of the appliance.

Particular attention must be paid to older patients who may have limitations in eyesight or dexterity. Patients with a high-output stoma are at particular risk for skin irritation and ulceration if they do not have an appropriately fitted appliance. Obesity has been frequently reported to be associated with an increased risk of skin irritation, likely owing to technical problems with stoma construction. Consideration should be given to placing the stoma in the upper abdomen where there is typically much less subcutaneous fat and the patient can see it much more readily.

The patient should be instructed to avoid creams or ointments that may interfere with the adherence of their appliance. In the postoperative period, a stoma will tend to become less edematous and the abdomen becomes less distended. As such, it is quite common to need to “downsize” the appliance at the first postoperative visit to minimize exposed skin. Changing a stoma too frequently may lead to excessive wear and tear on the parastomal skin; on the other hand, too long an interval between changing the appliance may be associated with erosion of the protective barrier.

Even with the help of an excellent ET, specific skin infections may occur. Fungal overgrowth is evident when there is a bright red rash around the stoma with associated satellite lesions. This is typically easily treated by dusting the parastomal skin with an appropriate antifungal powder or an oral agent in refractory cases. If the dermatitis conforms precisely to the outline of the stoma appliance, then an allergic reaction to the wafer or other component of the appliance is likely the culprit. Peristomal skin irritation may also be associated with reactivation of inflammatory bowel disease.

Fortunately, most cases of skin irritation and leakage are readily managed by conservative means. However, a redundant pannus, surgical scars, or creases with poor stoma siting may result in the need for revisional surgery. Revising the site of the stoma or combined abdominal wall recontouring and stoma revision may be necessary.16

HIGH-OUTPUT STOMAS

For obvious reasons, a high-output state is typically described in association with an ileostomy rather than a colostomy. Marked diarrhea and dehydration occur in 5% to 20% of ileostomy patients, with the greatest risk occurring in the early postoperative period. An ileostomy usually functions by the third or fourth postoperative day. The output typically peaks on the fourth postoperative day, with an output of up to 3.2 L reported. Because the ostomy effluent is rich in sodium, hyponatremia can be a problem. The particular window of vulnerability for dehydration appears to be between the third and eighth postoperative day. In time, the small bowel typically adapts with mucosal hyperplasia and there is a steady decrease in ostomy output. However, patients with an ileostomy, particularly those who have had concomitant small bowel resection, are at risk to become dehydrated. Most often, this is easily managed by oral rehydration with one of the commonly available sports drinks. However, patients who have lost considerable absorptive surface owing to previous bowel resection and/or those with recurrent/residual Crohn disease are at particular risk. In addition to the loss of absorptive surface area, ileal resection also removes the fat or complex

**FIGURE 179-10** Skin irritation around the stoma site from a poorly fitting appliance.
carbohydrate stimulation of the so-called ileal brake, which slows gastric emptying and small bowel transit. Fluid and electrolyte maintenance in these patients may require a period of parenteral hydration and nutrition.

*Clostridium difficile* enteritis is an increasingly reported cause of ileostomy diarrhea, especially in patients who have had a total colectomy for inflammatory bowel disease. The typical presentation is ileostomy diarrhea followed by ileus. This condition has been associated with a high mortality, although early recognition and treatment appears to be associated with better outcomes.

Ileostomy diarrhea may be treated in its milder forms with oral fiber supplements or cholestyramine, which can thicken secretions. Histamine receptor antagonists or proton pump inhibitors are often useful in reducing gastric fluid secretion, especially in the first 6 months after surgery when hypergastrinemia is most severe. Often, antimotility agents (e.g., loperamide or diphenoxylate) or opiates (e.g., codeine or tincture of opium) may be required to slow intestinal transit. In refractory cases, somatostatin analogue has been used with some success. Somatostatin reduces salt and water excretion and slows gastrointestinal tract motility. However, its clinical usage has met with variable results. Special mention is made of patients with a high ostomy required to treat complications of an anastomotic leak. Good results have been reported with exteriorizing the leak and reinfusing the ostomy effluent into the downstream limb until gastrointestinal continuity can be restored. This has led to weaning parenteral nutrition in a substantial number of patients.

A related problem in patients with an ileostomy is the development of urinary stones. The obligatory loss of fecal water, sodium, and bicarbonate reduces urinary pH and volume. Whereas approximately 4% of the general population develop urinary stones, the incidence in patients with an ileostomy is approximately twice that. Whereas uric acid stones comprise less than 10% of the calculi in the general population, they comprise 60% of stones in ileostomy patients. There is also an increase in the incidence of calcium oxalate stones.

**BOWEL OBSTRUCTION**

Life table analyses suggest that bowel obstruction is a rather common complication of ostomy creation. Twenty-three percent of patients with an ileostomy ultimately develop bowel obstruction. Adhesions are probably the most common cause, but small bowel volvulus or internal hernia may be the culprit. Although it is frequently mentioned that suture of the mesentery to the lateral abdominal wall may prevent volvulus or obstruction, retrospective analyses have not shown any benefit to this maneuver. Treatment is not dissimilar to other patients presenting with a mechanical small bowel obstruction.

However, special note must be made of food bolus obstruction. Many patients with an ileostomy may develop signs and symptoms of bowel obstruction owing to the accumulation of poorly digested foodstuffs (e.g., popcorn, peanuts, and fresh fruits and vegetables). A careful history may reveal dietary indiscretions. Further, the possibility of a food bolus obstruction should be considered in any patient with an ileostomy who has radiologic evidence of a distal obstruction. A red rubber catheter may be inserted gently into the ostomy and saline irrigation initiated. If suspicious concretions begin to pass into the stoma, the irrigations may be carefully repeated until the obstruction is relieved.

**ISCHEMIA**

Edema and venous congestion are very common after stoma creation owing to mechanical trauma and compression of the small mesenteric venules as they traverse the abdominal wall. This is typically self-limiting and requires no treatment. However, ischemia may be related to tension on the mesentery or excessive mesenteric division, particularly in obese patients or those undergoing emergency surgery. A common error is dividing the sigmoidal vessels to obtain the length to allow a colostomy to reach the skin. In these cases, the inferior mesenteric vessels should instead be divided proximally and/or the splenic flexure mobilized, preserving the sigmoid arcades.

If ischemia becomes apparent, a glass test tube or flexible endoscope may be inserted into the stoma. If the stoma is viable at fascial level, then the patient may be carefully observed. However, if there is question about the viability of the stoma at the fascial level, immediate laparotomy and stoma revision is required. Early ischemia is seen in 1% to 10% of colostomies and 1% to 5% of ileostomies.

**PARASTOMAL HERNIA**

Parastomal hernia is probably the most common stoma complication requiring operative intervention (Figure 179-11). A parastomal hernia develops in 2% to 28% of patients with an end ileostomy and 4% to 48% with an end colostomy. The occurrence of these hernias increases with time; as such, the reported incidence depends greatly on the length of followup. Most patients with a parastomal hernia can be managed expectantly or with a belted appliance; however, patients with unrelenting pain, obstruction, or difficulty maintaining an appliance generally require surgical repair.

Patient-specific factors such as obesity, advanced age, and chronic obstructive pulmonary disease appear to increase the risk of parastomal herniation. From the
technical standpoint, making the smallest possible opening in the abdominal wall without making the stoma ischemic seems prudent. However, many of the other “preventive” measures such as lateral space closure, fascial fixation, or stoma placement through the rectus muscle, appear to have no effect on the incidence of these hernias. The use of prosthetic mesh prophylactically, especially in the sublay position, may reduce the risk of parastomal herniation.31,32

Unfortunately, the results of surgical correction have historically been poor, highlighting the importance of careful patient selection and prudent attempts at conservative management in patients without clear indications for surgery. In one of the largest reported series, 63% of patients developed a recurrent hernia and 63% had at least one complication.33 The most commonly described techniques are direct repair, stoma relocation, and mesh repair. The recurrence rate with mesh repairs (0% to 33%) clearly appears to be lower than that of direct repair (46% to 100%), or stoma relocation (76%).29,34,35

A wide variety of mesh repairs have been described, but it remains uncertain what type of mesh should be used and what the optimal position is for placement. The intraperitoneal or underlay mesh repair, championed by Sugarbaker, has probably been associated with the most encouraging results.36 Intraabdominal pressure tends to keep the mesh in place. One benefit of the intraperitoneal technique is that a concomitant incisional hernia may be repaired at the same time. Various laparoscopic techniques have been successfully utilized for intraperitoneal mesh placement.37-39 Concerns have been expressed about the long-term risk of mesh erosion, prompting interest in the use of biologic mesh materials.40,41

Mesh may also be placed using an extraperitoneal fascial onlay technique.42,43 A curvilinear lateral incision is made outside the outline of the stoma wafer. The hernia sac is entered and omentum and bowel are reduced. An onlay mesh is secured to the fascial defect. The advantage of this technique is that it avoids a major intraperitoneal procedure, making it attractive in patients who are poor candidates for laparoscopy/laparotomy. However, the recurrence rate with this procedure is undoubtedly much higher than with underlay placement of the mesh.

STENOSIS

Stoma stenosis may result from ischemia, excessive tension, retraction, or recurrent inflammatory bowel disease. The reported incidence is typically less than 10%.12

Mild asymptomatic stenosis does not require any treatment. Skin-level stenosis is readily treated with local procedures such as a Z- or W-plasty,44 whereas those associated with Crohn disease usually require formal bowel resection. Timing of surgery is an important consideration in patients with a retracted and/or stenotic stoma. Fourteen percent of colostomies and 12% of ileostomies develop retraction within 3 weeks of surgery45; many of these will develop a stenosis, ultimately requiring revision. With good enterostomal therapy (e.g., use of a convex pouch) and temporizing measures such as gentle digital dilation, the acute inflammatory response is permitted to subside. This facilitates the ability to perform a local revision at a later date when the bowel and mesentery are less friable and rigid.

PROLAPSE

The risk of stoma prolapse has been reported to be 11.8% at 13 years (Figure 179-12).12 Transverse loop colostomies are especially notorious for prolapse (Figure 179-13); the efferent limb is virtually always the offending cause. Although somewhat controversial, this is a primary reason why loop ileostomy is commonly preferred to loop colostomy for temporary fecal diversion.46,47 Although often advocated, mesenteric fixation or lateral space closure do not appear to reduce the incidence of stoma prolapse.

Although the prolapse is often unsettling to the patient or healthcare providers, asymptomatic prolapse requires no treatment, especially if the stoma is temporary. When the prolapse causes ischemia, obstruction, or pouching problems, surgical intervention is warranted and usually straightforward. The stoma is freed up from the abdominal wall and the bowel delivered until taut.
The redundant bowel is amputated and the mucocutaneous border reestablished. In cases of incarcerated prolapse without advanced ischemia, sugar can be applied as a desiccant to facilitate reduction and obviate the need for urgent surgery.48

PERISTOMAL VARICES

Stomal varices may cause life-threatening hemorrhage. The varices occur at the level of the mucocutaneous border of the ostomy secondary to the anastomoses between the high-pressure portal venous system and the low-pressure subcutaneous veins of the abdominal wall.49 The diagnosis is suspected in ostomates with serious liver disease. Peritoneal peristomal veins are particularly vulnerable to hepatic congestion.49 Portal venous decompression can be achieved by surgical, catheter-directed, or endoscopic techniques.49

REFERENCES


SUGGESTED READINGS