Stoma Complications

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Abstract

When created properly, an ileostomy or colostomy can dramatically improve a patient's quality of life. Conversely, when a patient develops complications related to their stoma, the impact on physical and mental health can be profound. Unfortunately, significant morbidity is associated with stoma creation conveying high rates of both early and late-term complications. Early complications include stomal ischemia/necrosis, retraction, mucocutaneous separation, and parastomal abscess. Late complications include parastomal hernia, prolapse, retraction, and varices. This review will discuss commonly occurring nondermatological stoma complications and detail management strategies for the ostomate and the surgeon.

Keywords

- parastomal hernia
- stoma prolapse
- colostomy
- ileostomy
- parastomal varices

Roughly 150,000 stomas are created in the United States annually, equally divided between ileostomies and colostomies.[1] When created properly, an ileostomy or colostomy can dramatically improve a patient's quality of life. Patients with a good functioning stoma can expect to live a normal life with very few lifestyle restrictions. In contrast, when a patient develops complications related to their stoma, the impact on their physical and mental health can be irreparable. Stomas can be created for a multitude of diseases such as colorectal cancer, ulcerative colitis, Crohn's disease, diverticulitis, ischemic colitis, radiation injury, and fecal incontinence. The associated morbidity and overall function of a stoma are dependent upon the indication for the stoma, whether it was created electively or emergently, and patient factors such as body habitus and prior surgery.

Unfortunately, significant morbidity is associated with stoma creation and these complications can be grouped into early and late-occurring complications. The literature reports the rate of stoma-related complications ranging from 20 to 70%.[2–7] Early complications occur within the first 30 days of the stoma creation and include ischemia/necrosis, retraction, mucocutaneous separation, and parastomal abscess. Late complications include parastomal hernia, prolapse, retraction, and varices. All of these complications will be discussed to better understand etiologies and management options.

Risk Factors for Stoma-Related Complications

As mentioned previously, stoma creation carries significant morbidity, and disease, patient, clinical, and stoma-specific factors influence the outcomes pertaining to their creation. Harris et al found the most common stoma-related complications in 345 ostomates were herniation, retraction, necrosis, infection, prolapse, stenosis, fistula, and small bowel obstruction (SBO).[4] Complications were more common with colostomies except for SBO, which were more prevalent with ileostomies. The authors also found that loop colostomies had the highest complication rate out of all stoma configurations. Postoperative stoma necrosis was strongly and significantly associated with emergency stoma creation. Parmar et al identified that colostomies, short stoma length, body mass index > 30, emergency surgery, and lack of preoperative marking were associated with increased risks of complications.[7] None of the identified studies was adequately powered to stratify postoperative stoma-related complication rates by specific disease processes.

Parastomal Hernia

Parastomal hernias are incisional hernias at ostomy sites and are believed to be an inevitable consequence of having an

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Table 1 Indications for repair of a parastomal hernia

Absolute
Obstruction
Incarceration with strangulation
Relative
Incarceration
Prolapse
Stenosis
Intractable dermatitis
Difficulty with appliance management
Large size
Cosmesis
Pain

ostomy. Parastomal hernia incidence varies with stoma type and configuration (1.8–28.3% for end ileostomies and 0–6.2% for loop ileostomies, and 4–48% for end colostomies and 0–30.8% for loop colostomy).[8,9] The true incidence of parastomal hernias has been difficult to quantify given the lack of uniform definition of what constitutes a hernia, variable follow-up, and inadequacy of physical examination to diagnose early occurrences.[10] Studies designed with very careful follow-up suggest that a paracolostomy hernia develops in more than 50% of patients followed for longer than 5 years. Most parastomal hernias occur in the first 2 years but can occur up to 10 years after stoma creation.[11]

Undoubtedly, parastomal hernias can significantly affect patients' quality of life.[12] Symptoms related to parastomal hernias include mild peristomal discomfort, difficulty in maintaining an adequate appliance skin seal, obstruction, and strangulation. Even though the majority (~75%) of patients have some symptoms attributable to the presence of parastomal hernia,[13] these hernias are generally well tolerated. Life-threatening complications, such as bowel obstruction or strangulation, are rare. Select indications and contraindications are presented in ►**Table 1**.

Most parastomal hernias are diagnosed by a thorough clinical examination after removing the stoma appliance with the patient in a standing position. If clinical examination is equivocal, a computed tomography scan may be performed to confirm the diagnosis. Risk factors for development of parastomal hernias include obesity, malnutrition, advanced age, collagen abnormalities, corticosteroid use, postoperative sepsis, abdominal distention, constipation, obstructive uropathy, and chronic lung disease. Technical factors such as poor site selection, oversized fascial trephine (>3 cm),[14] excessive splitting and stretching of muscle fibers, epigastric nerve denervation, placing a stoma in an incision, and emergency stoma creation also contribute to the development of parastomal hernias. Stomas lateral to the rectus sheath were once thought to contribute to parastomal herniation; however, most studies[15,16] relating parastomal hernia to abdominal wall location were retrospective. To date, only one study has convincingly demonstrated significant benefit in placing stomas through the rectus muscle.[16]

Prevention of Parastomal Hernias

Alternative techniques for stomal construction, such as extraperitoneal tunneling,[17–19] stapled ostomy creation,[20–22] stoma–fascia fixation, and prophylactic mesh reinforcement for permanent colostomies, have been suggested; however, their role in parastomal hernia prevention is uncertain. Of these, the majority of evidence exists for extraperitoneal tunneling and prophylactic mesh reinforcement. A meta-analysis of 1,071 patients (from retrospective observational studies) who had a permanent colostomy created either through extraperitoneal versus intraperitoneal techniques found a lower rate of parastomal hernias in the extraperitoneal group (6.4 vs. 13.3%; OR: 0.41; $p = 0.002$). The benefits of extraperitoneal tunneling must carefully be balanced with increases in operative time and complications. Further randomized controlled trials are needed to identify a subset of high-risk patients who would unequivocally benefit from extraperitoneal tunneling in preventing parastomal hernias.

Prophylactic mesh placement at the time of initial stoma formation has been suggested to prevent parastomal hernias.[23–25] Studies have shown that prophylactic implantation of both biological and synthetic mesh in a preperitoneal or sublay position for both ileostomies and colostomies is safe, and theoretical concerns of mesh erosion, infection, and fistulization have not materialized. Randomized controlled trials with the use of lightweight polypropylene mesh have shown a decreased incidence (15 vs. 52%) of parastomal herniation with prophylactic mesh use.[23,26–29] These studies have had limitations such as small sample size, heterogeneous population, and variable follow-up. Limited data are available regarding prophylactic ostomy site reinforcement with bioprosthetic material.[30–32] A prospective multicenter randomized controlled study comparing standard stoma creation to reinforcement with porcine acellular dermal matrix showed a similar incidence of parastomal hernias at 24 months in both groups. Figel et al performed a value analysis on the routine use of bioprosthetic mesh for prevention of parastomal hernia. The authors reported to economically justify routine mesh placement at the time of stoma creation and that more than 39% of parastomal hernias would need to be repaired while concomitantly constraining mesh costs to $2,267 to $4,312.[33] Further large-scale randomized controlled trials with long-term follow-up are necessary to study late effects of prophylactic mesh placement and to identify situations where routine use of mesh is beneficial and cost-effective.

Surgical Repair of Parastomal Hernias

Fortunately, fewer than 20% of patients with parastomal hernias have an indication that mandates repair. Indication for repair of parastomal hernias is given in ►**Table 1**. The ideal treatment of parastomal hernia is to eliminate the stoma and restore intestinal continuity. Repair of parastomal hernias is recommended in patients with symptomatic

parastomal hernias where elimination of the stoma is not feasible or advisable. The three most frequently employed types of parastomal hernia repair are (1) local repair, (2) stomal relocation, and (3) prosthetic repair.

Local Repair (Direct Suture Repair)

Local repair involves a local exploration around the stoma site, with primary closure of the defect with either absorbable or nonabsorbable sutures. Potential advantages of this approach are avoidance of formal laparotomy and the ability to maintain stoma in the same location. Local repair should generally be avoided due to high recurrence rates (~75%)[10,34] and is typically reserved for use when major abdominal surgery or use of prosthetic materials is contraindicated.

Stoma Relocation

Stoma relocation may be required when parastomal hernia patients experience concomitant stoma complications such as pouching difficulty, retraction, and peristomal pyoderma gangrenosum (PG).[10,34] Although stoma relocation without a laparotomy has been reported, a laparotomy is required in majority of these cases, which leads to more morbidity than some of the other techniques.[35] Furthermore, stoma relocation exposes the patient to the risk of three new incisional hernias at (1) the old stoma site, (2) the laparotomy incision site, and (3) the new stoma site with reported recurrence rates ranging from 24 to 86%.[10,35] Parastomal hernia recurrence rates are higher after relocation to the ipsilateral (86%) versus contralateral (57%) side of the abdomen[34] and reported complication rates with this procedure range from 32 to 89%. Most data available on this technique are retrospective and observational but recurrence after stoma relocation appears to be lower than direct fascial repair.

Parastomal Hernia Repair with Mesh

Choice of Prosthetic Material

The ideal prosthetic material for parastomal hernia repair does not exist. Currently available prosthetic materials are classified as synthetic or biological depending on their composition. Synthetic prostheses are mainly composed of polypropylene, polyester, or expanded-polytetrafluoroethylene (ePTFE) and can be further classified as heavyweight or lightweight, micro- or macroporous, and composite and coated prosthesis based on their composition. Polypropylene and polyester substrates work by inciting an intense fibroplastic response along the implanted mesh to form a strong scar plate interface causing mesh integration with the surrounding tissues. Conversely, implanted ePTFE mesh substrates typically do not integrate well into surrounding tissues and heal by encapsulation whereby minimizing risk of erosion and fistulization of abdominal viscera. The use of mesh in parastomal hernia repair is associated with development of adhesions, bowel obstruction, wound infection, and development of enterocutaneous fistulae in 2 to 8% of the patients.[36,37] Composite mesh prosthetics composed of both polypropylene/polyester and ePTFE have been designed specifically for use in parastomal hernias in an effort to minimize these complications. The risk of parastomal hernia recurrence following repair with synthetic mesh is reported to be 16.7% with a mesh infection rate of 3%.[38]

Biological prosthetic meshes consist of acellular collagen matrix derived from biological sources (e.g., human, porcine, or fetal dermis; porcine small intestine submucosa; and bovine pericardium) and are processed to remove cells, antigens, and increase collagen cross-linking. This matrix acts as a scaffold to allow native tissue and neovascularization to infiltrate the healing wound and promote strong tissue in-growth that limits contraction. This ability of biological meshes to integrate with host tissues in theory allows these materials to tolerate infection, but infectious complications and even fistula formation has been reported[38] with biological prostheses. A systematic review with pooled data from multiple studies on use of biological mesh for parastomal hernias showed a pooled recurrence rate of 15.7% (7.8–25.9%) and wound-related complication rates of 26.2%. Another major drawback is that biological prostheses are significantly more expensive (10–20 times more) than synthetic materials. Given lack of high-quality data establishing superiority of biological prostheses over synthetic mesh materials, their routine use for parastomal hernia repair cannot be justified.

Hybrid materials combining the desirable qualities of both biological and synthetic mesh materials are currently being studied (e.g., Phasix mesh, Davol, Warwick, RI). Such materials are designed to slowly dissolve in a controlled fashion while possessing the mechanical strength and physical properties of a synthetic mesh. Preclinical in vivo and in vitro results using hybrid materials is favorable and further clinical evaluation with these materials is currently underway.

Open Repair with Prosthesis

Prosthetic parastomal hernia repairs are considered to be effective and durable, although few randomized trials can unequivocally prove this. Repair of parastomal hernias with mesh follows the same tenets of ventral hernia repair (i.e., fascial defect closure with a 3–5 cm mesh overlap). Mesh can be placed in an onlay, inlay, sublay, and intraperitoneal onlay mesh (IPOM) location.

Onlay parastomal hernia repair is typically performed with the mesh placed anterior to the anterior rectus aponeurosis. A "hockey-stick" shaped incision is first created outside the boundaries of the patient's appliance. The skin and subcutaneous tissue are then mobilized anteriorly to identify the fascial defect, which is closed primarily and reinforced with a prosthetic onlay. Undoubtedly, onlay mesh repairs can be problematic. Such undermining of subcutaneous tissues can cause seroma formation, which can progress to infection. Moreover, recurrence rates of up to 62.5% have been reported with onlay technique that can require mesh excision in up to 23% of patients.[39] Even worse, onlay parastomal hernia recurrence rates using biological mesh are reported to be unacceptably high, with one study reporting recurrence rates as high as 89% at only 10 months postoperation.[40]

Inlay parastomal hernia repair techniques use bridging mesh fixed to the fascial edges to fill the defect while permitting the enterostomy to traverse through a small trephine. Inlay hernia repair techniques have been largely abandoned due to high recurrence rates and wound-related complications.

Mesh can be placed in a sublay position dorsal to the rectus muscle and anterior to the posterior rectus sheath (i.e., retrorectus). Alternatively, mesh placement between the posterior rectus sheath and peritoneum has been described in small case series.[41,42] Posterior component separation with retromuscular mesh positioning is a technique that has been described in patients with complex parastomal hernias—typically multisite hernias enabling widely placed mesh to reinforce all "at risk" areas for hernia recurrence.[38,43] Average rates of parastomal hernia recurrence using sublay mesh placement is 5.7%

IPOM is an intra-abdominal prosthetic repair that eliminates the need for the abdominal wall dissection and is becoming increasingly popular. IPOM repairs enlist the mechanical advantages of placing the prosthesis on the peritoneal side of the abdominal wall, whereby using intra-abdominal forces to hold the mesh in place.[44] IPOM repairs can be performed using "keyhole" or "Sugarbaker" techniques. The keyhole technique involves intraperitoneal placement of a slitted mesh where a 2 to 3 cm circular cutout is fashioned through the center of the mesh. The resultant "keyhole" shape wraps snugly around the stoma conduit and fastens back upon itself to provide wide mesh coverage of the trephine. Sizing the keyhole shape appropriately is critically important since too small of an opening can obstruct the enterostomy while too large of an opening can result in hernia recurrence. Recurrence rates for keyhole IPOM parastomal hernia repairs are reported to be nearly 21%.[9] Keyhole meshes are thought to fail at areas of mesh overlap and from mesh contracture which can paradoxically enlarge the stoma trephine.

The Sugarbaker technique involves widely covering the entire fascial defect with mesh, except for one side where the stoma conduit tightly traverses along a coronal plane between mesh and peritoneum. The resultant configuration effective creates a type of flap valve at the stoma trephine.[44] Mesh shrinkage and aperture widening is theoretically minimized since a solid sheet of mesh is used in this technique, and the reported recurrence rate with this repair is 11.6%.[9] One major drawback of this technique is the possibility of bowel obstruction and mesh erosion at the interface between the bowel wall and mesh edge.

Laparoscopic Repair of Parastomal Hernia

Laparoscopic parastomal hernia repair offers advantages of avoiding a large incision while providing a superior view of the hernia defect and facilitating wide intraperitoneal mesh placement.[45] The intra-abdominal approach is particularly suited for laparoscopy, and several techniques have been described.[46] Currently descried techniques of laparoscopic repair include laparoscopic versions of Sugarbaker and keyhole techniques. The sandwich technique, which combines both keyhole and Sugarbaker techniques, offers recurrence rates ranging from 0 to 47% with mesh infection rates up to 16%. This technically challenging procedure conveys high conversion rates to open procedure approaching 15% and has a 10% rate of mesh explantation.

Stoma Prolapse

Stoma prolapse is full-thickness protrusion of bowel through a stoma that occurs in 3% of ileostomies, 2% of colostomies, and 1% of urostomies.[47] Stoma prolapse can be classified as sliding (if occurs intermittently with increased intra-abdominal pressure) or fixed (if it is present constantly). Prolapse occurs more frequently with loop colostomies than end colostomies and most frequently involves the efferent (distal) limb. Risk factors for stoma prolapse include patient factors such as advanced age, obesity, bowel obstruction at the time of stoma creation, and lack of preoperative site marking by enterostomal nurse.[48] Techniques proposed to limit stoma prolapse include extraperitoneal tunneling, mesentery-abdominal wall fixation, and limiting the size of the aperture. Symptoms associated with stoma prolapse include pain, skin irritation, difficulty with maintaining an appliance, and can rarely lead to obstruction, incarceration, and strangulation. Acute stoma prolapse can often be reduced at the bedside with the aid of sugar and ice to reduce bowel wall edema, allowing for an elective repair if prolapse was to recur.

Surgical options for stoma prolapse repair include reversal of a temporary stoma (when possible and feasible), resection, revision, or relocation.[5] Resection of the prolapsed segment is performed by incising the mucocutaneous junction, mobilizing and amputating the prolapsed segment, and rematuring a new, more proximal stoma. A prolapsing loop stoma can be remedied by converting it into an end or an end-loop configuration. Loop stoma conversion to an end-loop stoma is performed by incising the mucocutaneous junction and transecting the bowel used to create the loop stoma into a distal and proximal segment. The prolapsed bowel segment, which tends to be the distal (efferent) limb, is returned to the abdominal cavity or matured as a mucus fistula.[49–51] Stoma relocation can be considered when a prolapsed stoma is located at a suboptimal site, leading to pouching issues or associated skin complications.

Stoma Necrosis

Stoma necrosis is an early postoperative complication resulting from inadequate stomal blood supply that can occur in up to 13% of ostomates.[4,5] Stoma necrosis is most commonly associated with colostomies, emergent operations, and obesity.[3] Frequently, a stoma will appear mildly dusky in the immediate postoperative period, and it is important to distinguish between early venous congestion and arterial insufficiency. Venous congestion due to swelling or constriction of the stoma allows adequate arterial inflow but occludes venous drainage causing the stoma to swell and turn cyanotic or purple-colored. As postoperative edema subsides, venous outflow improves and the

stoma will assume a normal postoperative hyperemic hue. Rarely, edema and venous outflow obstruction can cause transient mucosal sloughing, which can be tolerated provided the underlying bowel wall is viable. However, inadequate arterial inflow will cause full-thickness necrosis and generally cannot be tolerated.

The main cause of stoma necrosis is devascularization of the bowel conduit used for stoma creation. Devascularization can occur due to ligation of the primary blood vessel to that segment of bowel, inadequate collateral blood flow, or by excessive removal and dissection of peristomal mesentery (i.e., "cleaning off" the mesentery). Ischemia noted in the operating room should be immediately revised. Stoma revision techniques employed are dependent upon the length of ischemic bowel segment. Short segments (i.e., <5 cm) of ischemia limited to the distal stoma aspects can be ameliorated with simple mobilization to bring viable bowel to the skin surface. For example, an ischemic left-sided colostomy can sometimes be further mobilized without mobilization of the splenic flexure, with medial mobilization of the mesentery, and high inferior mesenteric vein ligation. Longer ischemic segments of bowel may require proper resection including mesentery division and full splenic flexure mobilization.

Often, full-thickness stoma necrosis does not become evident until several postoperative days. The management of delayed postoperative stoma ischemia depends upon the proximal extent of ischemia. Delayed colostomy necrosis or ischemia anterior (or distal) to the fascial level may carefully be observed and may not require stoma revision. While stomal stenosis may result, conventional wisdom dictates that it is better to leave the stoma in situ and manage it with local pouching strategies since the underlying conditions responsible for necrosis have worsened since stoma creation. Early, intense, postoperative inflammatory adhesions, bowel and mesentery edema, and abdominal wall impair stoma mobility making stoma revision difficult during the first few postoperative months.

In contrast, immediate reexploration and revision are necessary when stoma ischemia extends below (or proximal) to the fascial level. The proximal extent of ischemic changes can be assessed most effectively with endoscopy. Conversely, a bedside examination using a flashlight and lubricated glass test tube inserted into the stomal os allows evaluation of the most distal 5 to 6 cm of stoma mucosa. If there is concern that the process extends to or below the abdominal wall fascia, the patient should be taken to the operating room for thorough assessment. For ischemia extending into the peritoneal cavity, a laparotomy should be performed to enable stoma resection and revision. Once the stoma is taken down, the extent of ischemia can be determined. The extent of the bowel resection depends upon the extent of necrosis and ischemia and ultimate on the ability of the bowel conduit to reach the skin level. The surgeon must be prepared to create a new stoma at a new site and/or resect the remaining bowel conduit. Stoma necrosis is very uncommon for loop stomas, given the blood supply duality (i.e., through proximal and distal limbs).

Stoma Retraction and Stenosis

Stoma retraction results when the stoma pulls on the mucocutaneous junction causing it to separate or invert. Stoma retraction tends to arise from a combination of inadequate bowel mobilization, leading to mucocutaneous tension and ischemia, or a heavy bulky mesentery in the setting of obesity, malnourishment, and immunosuppression. The best methods to prevent stoma retraction focus on ensuring adequate mobilization and blood supply to the stoma conduit and creating an adequately sized fascial aperture to facilitate delivery of the stoma to the skin. When stoma retraction does occur, management depends upon the degree of retraction and the presence of a concomitant stenosis. Stenosis can occur at the level of the skin or at the level of the fascia, but when it occurs at the level of the skin, it is almost always associated with stoma retraction. The rate of stoma retraction has been reported to range from 1 to 30% as is most commonly associated with colostomies and emergent operations. The rate of stenosis is typically much less, ranging from 1 to 9%.[4,7]

Convex stoma appliances can be used to help prevent leakage for retraced stomas with an intact mucocutaneous junction. Appliance convexity theoretically increases the surface area of the appliance–skin interface by flattening out peristomal skin in an attempt to decrease peristomal leakage. Revision of the stoma becomes necessary if stoma pouching changes are not successful.

Early postoperative mucocutaneous separation and stoma retraction will commonly result in late term stoma stenosis. The circumferential skin wound that arises from separation will granulate and heal slowly by secondary intention. Secondary healing causes wound contracture resulting in a shrinking and stenosing stoma, which can present a problematic situation that may ultimately require revision or relocation. The timing of such corrective stoma surgery, however, is nuanced. Ideally, large intra-abdominal operations would be delayed for several weeks to allow early intra-abdominal postoperative inflammation to subside. Such a delay may require fastidious and complex temporizing stoma care until stoma revision can be safely performed. Local stoma revisions can be attempted without entering the abdominal cavity; however, the surgeon must be prepared for a large operation if intra-abdominal adhesions prove formidable or an enterostomy is made. Local stoma advancement involves excising the stenotic opening resulting in a widened trephine that accommodates the locally mobilized stoma conduit. Additional stoma length can be obtained by dissecting the bowel conduit free into the peritoneal cavity. If the proximal bowel can be adequately mobilized to reach the skin without tension, the stoma can be amputated at the level of healthy bowel and rematured to the skin. If local dissection fails to liberate adequate conduit length to permit local stoma revision, a laparotomy is typically required to gain an adequate length of mobilized bowel to create a healthy, tension-free, protruding stoma.

Fascial stenosis and Crohn's disease can lead to a stenotic stoma. Fascial strictures can result from the creation

of an inadequately sized fascial aperture and account for approximately 1% of stomal stenoses.[4,7] Fascial stenosis can cause obstructive symptoms or frequent food bolus obstructions in afflicted patients. This situation can be managed by enlarging the stoma aperture either locally or through a laparotomy. Crohn's disease stenoses merit careful evaluation of the extent of active disease and thoughtful consideration of the medical therapy prior to stoma resection or revision.

Parastomal Varices

Parastomal varices form in patients with portal hypertension and a stoma where there is portosystemic collateralization between the portal system of the stoma and the systemic venous system of peristomal skin. These unintended shunts result in engorged and pressurized subcutaneous vasculature that creates a peristomal caput medusa. Fortunately, stomal varices are uncommon, but bleeding can be quite profound and troublesome. As a rule, the best method to prevent peristomal varices is to avoid creating stomas in portal hypertensive patients. Inflammatory bowel disease (IBD) with concomitant primary sclerosing cholangitis is the most common setting in which stoma varices occur.[52] Stomal variceal bleeding can arise from focal points at the mucocutaneous junction or the skin, which can be fleetingly treated with suture ligature, compression, or coagulation. Unfortunately, recurrent bleeding is expected and therefore local methods are considered temporary at best. Brisk or diffuse life-threatening hemorrhage from circumferentially congested and oozing varices typically requires systemic means of reducing portal pressures. The most effective means of reducing portal pressures is transjugular intrahepatic portosystemic shunt (TIPS) or liver transplantation.[53–55] The success of TIPS at preventing peristomal variceal rebleeding has been reported to be 60 to 90% when used alone. When TIPS is combined with percutaneous embolization, the risk of rebleeding can be reduced to 5 to 25%. For percutaneous embolization or occlusion, the mesenteric venous system is accessed retrograde through the portal system. The mesenteric veins can be sclerosed with an agent such as 1% sodium tetradecyl sulfate or balloon occluded. Stomal variceal bleeding is a relatively uncommon source of bleeding; therefore, the compendium of literature is limited to small case series and literature reviews. However, the data as a whole do support the use of TIPS in combination with venous obliteration as the most effective nontransplant method to treat bleeding stoma varices.

Pyoderma Gangrenosum

Peristomal PG is characterized by painful, undermining, peristomal ulcerations that can interfere with stoma appliance application. PG lesions tend to start as small erythematous papules that coalesce into larger indurated ulcers with undermined edges, skin bridges, and an erythematous outer halo. PG is considered an extraintestinal manifestation in IBD patients but is associated with other autoimmune, rheumatological, and inflammatory disorders. Idiopathic peristomal PG has also been reported in patients without IBD or attributable comorbidity. For patients with IBD, PG severity does not always correlate with activity of the underlying IBD. Onset of PG has been reported from 2 weeks to 3 years after creation of a stoma.[56] PG is diagnosed clinically. Rarely, a biopsy that demonstrates granulomas can confirm the diagnosis while excluding competing diagnoses such as infection, malignancy, and other dermatopathies. Since PG is diagnosed clinically, the role of diagnostic skin biopsy is mired in controversy since the resultant biopsy wound can become a nidus for rapid PG progression. Successful management of peristomal PG involves rigorous local wound care and stoma management with the help of an enterostomal therapist. The basic principle for PG wound care is to create and maintain a dry skin surface by using nonadherent or absorbent dressings while carefully using pouching systems to ensure adequate sealing and minimization of local skin trauma inflicted by the pouch system itself. Use of topical therapies such as antimicrobial agents, corticosteroids, 5-aminosalicylic acid, sodium cromoglycate, and nitrogen mustard has been described. Systemic corticosteroids, pentoxifylline, immunomodulators, immunosuppressive agents, and antibiotics can be used for lesions resistant to local therapy.[57,58] In addition, the use dapsone, minocycline, hyperbaric oxygen therapy, topical cromolyn sodium, and tacrolimus has also been described in patients with PG. Surgical options for peristomal PG include debridement of ulcers and intralesional steroid injection. In patients who fail all of the above, stoma relocation may be attempted, but recurrences of peristomal PG are common and have been known to occur immediately after stoma relocation. Intriguingly, the risk of developing recurrent PG is not decreased with stoma relocation. The most effective treatment for PG is to reestablish intestinal continuity if at all possible.

Conclusion

Stoma formation is a frequently performed surgical procedure associated with high rates of postoperative complications. Stoma complications can significantly affect patients' quality of life and sense of well-being while burdening the health care system. It is critical for the surgeon to possess a thorough understanding of stoma complications and treatment. Detail-oriented attention at the time of stoma creation, especially in case of permanent stomas, can help minimize the morbidity associated with this procedure.

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