Endoscopy after bariatric surgery (with videos)

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Currently several bariatric surgical procedures offer effective weight loss in morbidly obese individuals, and many of these procedures are performed by using a variety of evolving techniques. Each procedure is associated with specific GI complications and poses unique challenges for postoperative endoscopic evaluation. This article reviews the endoscopic management of patients after bariatric surgery.

As previously detailed in this series of articles, several surgical procedures exist to induce weight loss in obese patients. Each procedure poses its own set of risks for postoperative GI complications and challenges for postoperative endoscopic evaluation. As part of the evaluation, the operative notes and any postoperative imaging studies should be reviewed to obtain an accurate, detailed understanding of the postoperative anatomy. Roux-en-Y gastric bypass (RYGB) is the most common procedure encountered by the gastroenterologist. Video 1 (available online at www.giejournal.org) demonstrates the normal endoscopic appearance of RYGB anatomy with a healthy gastric pouch, end-to-side gastrojejunal anastomosis, healthy Roux limb, normal-appearing side-to-side jejunojejunal anastomosis, and alternative side-to-side anastomosis. Sutures and staples are commonly visualized and do not need to be removed unless thought to be related to ulcer formation or specific symptoms, as detailed later in this review.

Each of these procedures is also associated with specific GI complications. The rates of early complications such as bleeding, anastomotic leaks, and wound infection range from 0% to 5% and depend on many variables including surgical expertise.[1-9] Late complications such as luminal stenosis, gallstones, fatty liver, and primary surgical failure may also occur after any procedure with varying incidence. Other late complications are more procedure specific. Gastrogastric fistulae are more common with incontinuity RYGB, although they are still seen in divided RYGB.[10,11] Additionally, numerous variations in RYGB that are surgeon specific can lead to different complications. Some surgeons prefer to use a Silastic band at the distal pouch to prevent dilation of the gastrojejunal anastomoses; however, these can migrate or even erode into the stomach over time.[12,13] Many surgeons use a retrocolic technique with the Roux limb passing through the mesocolon, which may eventually lead to stenosis, bowel obstruction, or internal hernia.[14-16] In other cases, the length of the Roux limb may vary, some being shorter (45-60 cm) and some being longer (>150 cm). Even the type of stapler used (circular or linear) is an independent predictor of the development of a gastrojejunal stricture.[17] It is therefore essential for the endoscopist to obtain and carefully review the operative report before performing endoscopy in the gastric bypass patient. An understanding of the procedural details and patient symptoms is required to determine appropriate management.

Symptoms usually direct the clinical evaluation of these postoperative conditions, and endoscopy is often used as part of the diagnostic or therapeutic algorithm. Nausea is a common postoperative symptom; however, when this is persistent or intense, an endoscopic evaluation should be performed to exclude reflux esophagitis, ulcer disease, and stenosis. Emesis may also be seen postoperatively and is typically caused by rapid food intake, insufficient mastication, or consumption of unsuitably large meals. Further evaluation should be considered when symptoms occur in the setting of appropriate eating habits or with foods that were previously tolerated in the postoperative period. Endoscopy can effectively assess the integrity of the pouch mucosa and detect stomal stenosis. Retrosternal or epigastric pain is not normal postoperatively and may be caused by acid reflux, bile reflux, ulceration, or band erosion. An endoscopy should be performed if symptoms do not respond to nutritional guidance or change in eating pattern. If no cause is identified, an abdominal CT scan should also be considered to exclude abscess or seroma.

The most common pathologic causes of these symptoms include stomal ulceration, stomal stenosis, and band erosion. Esophageal reflux and esophagitis may also cause these symptoms and are usually seen with

Abbreviation: RYGB, Roux-en-Y gastric bypass.

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gastric banding or in the setting of intragastric fistulae. Each of these conditions is addressed in detail in the following.

Stomal or marginal ulceration is a well-recognized complication of bariatric surgery that often presents as retrosternal or epigastric pain. The incidence of stomal ulceration is between 0.6% and 16%.[18-21] It is believed that ulceration may occur at any time; however, symptoms most commonly develop in the first 3 months after the procedure with a progressively decreasing incidence thereafter (Fig. 1).[19] The exact cause is unclear, and many factors are thought to be associated with their development including mucosal ischemia, nonsteroidal anti-inflammatory drugs, gastrogastric fistula, *Helicobacter pylori*, increased acid exposure, pouch size, and pouch orientation. When ulcers are identified, the pouch must be carefully examined for a fistula. Staple-line dehiscence and formation of a gastrogastric fistula result in the pouch, stoma, and jejunum being bathed in gastric acid. Loss of the bicarbonate buffer provided by the duodenum seen in bypass procedures leaves the jejunum particularly susceptible to injury. One series found that stomal ulcers were associated with gastrogastric fistulae in as many as 65% of cases.[20] When stomal ulcerations are not associated with staple-line dehiscence, management consists of evaluating the pouch pH and *H pylori* status, soluble proton pump inhibitor therapy, liquid sucralfate, and elimination of ulcerogenic medications. *H pylori* treatment before surgery is essential, but this may not always guarantee the absence of postoperative ulcers.[22] In the postoperative gastric bypass patient, pouch biopsies for *H pylori* may be fruitful; however, biopsies and urease breath test are unreliable in excluding disease, and newer fecal antigen testing will likely be the test of choice.[23-25] Ulcers may also form as a result of a foreign body reaction to nonabsorbable suture or staples, and endoscopic removal of this foreign material may result in resolution of the ulcer and symptoms (Fig. 2).[26,27] If deep ulcers persist despite these measures, surgical revision may be required to address chronic pain and prevent complications such as perforation, recurrent bleeding, and anastomotic strictures that may develop through cicatrix formation.

Stomal stenosis is a related yet considerably different problem. The most common sites of postoperative stenosis are the gastric band, gastrojejunal anastomosis, site of passage through the mesocolon, jejunojejunal anastomosis, and adhesions. The most common of these is stenosis of the gastrojejunal anastomosis with an incidence of between 4% and 19%.[28-31] Anastomotic stenosis may arise from ischemia or ulceration, as described previously. Stenosis occurs less frequently at the other sites, with rates ranging from 0% to 2% for the various procedures.[7,29,30] These rates are somewhat dependent on the procedural details and technique; circular staplers have a significantly higher rate of gastrojejunal stricture than hand-sewn or linear staplers, with a reported odds ratio of 11.3.[17] Gastrojejunal strictures

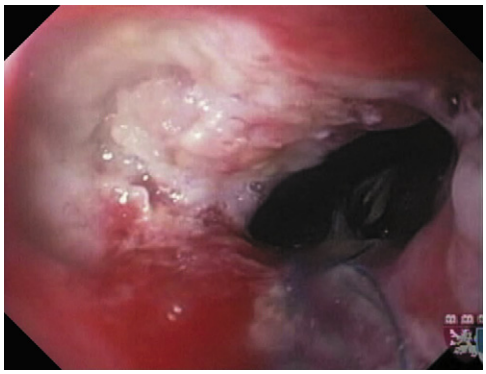

Figure 1. Stomal ulceration.

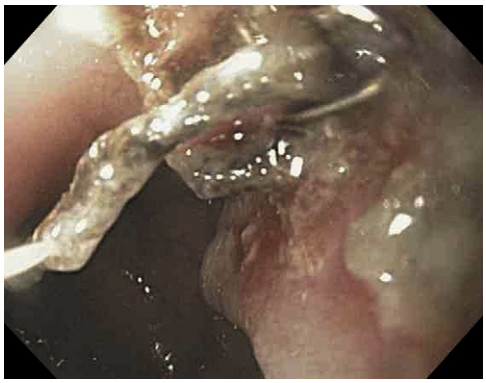

Figure 2. Foreign body (suture and staple) in the bed of an ulcer.

are generally amenable to endoscopic balloon dilation, which is successful in 66% to 93% of patients. Two to 4 sessions with progressively larger balloons may be required to achieve optimal long-term results.[28,32-35] It was also demonstrated that dilation to 15 mm during initial endoscopy was associated with a lower rate of repeat endoscopic dilation and did not adversely affect weight.[35] This, however, must be guided by the initial aperture and related features of the stenosis. Suture material at the site of the stenosis can also inhibit full expansion of the dilation balloon and may need to be removed before dilation to achieve procedural success (Video 2, available online at www.giejournal.org).[36] Additionally, needle-knife electrocautery incision, instead of balloon dilation, has been used with success. Some clinicians have also reported success with injecting the tissue at the stenosis with saline solution or steroids after balloon dilation. This is believed to help prevent restenosis by disrupting the underlying scar tissue and preventing its reformation; however, the exact mechanism is currently unknown.[37]

Mechanisms of stenosis after gastric banding include fibrous reaction to the band, band rotation off the horizontal axis, and adhesions with pouch angulation. Dilation may be effective in contending with stenosis caused by a fibrous reaction but is rarely useful in the setting of a tipped band. Such patients should not be subject to repeated dilations. If endoscopic dilation is not successful, several

surgical options are available including band removal, band replacement, and conversion to gastric bypass. Conversion to Roux-en-Y gastric bypass seems to be the most effective solution, providing correction of the stenosis and equal or greater weight loss.[38] Endoscopic balloon dilation has also been shown to be safe and effective in stenoses that occur after surgical revision of bariatric procedures.[33]

Gastric band erosion may present with symptoms characteristic of stenosis or ulceration and is easily identified with endoscopy (Fig. 3). The traditional approach is surgical revision; however, there are reports of expectant management with endoscopic removal on full intragastric erosion (Video 3, available online at www.giejournal.org).[36,39,40] Gastric bands that erode transmurally or have not freely eroded into the stomach lumen but remain partially embedded within and outside the gastric wall have been removed by using endoscopic scissors to cut and pull the band.[40] It must be noted that the endoscopically removed bands were not of the Lap-Band or adjustable band type because removal of these bands would require a joint laparoscopic and endoscopic approach because of the tubing that connects the band to a reservoir in the subcutaneous tissue. For this reason, endoscopic removal of adjustable gastric bands is currently best avoided and not recommended. Additionally, some endoscopists recommend CT imaging of the abdominal cavity and band before attempted endoscopic removal to confirm band encapsulation.[36] For symptomatic patients with partially eroded adjustable gastric bands, there are several surgical reparative techniques including conversion to gastric bypass, creation of a new stoma with band replacement, and gastroplasty with distal gastric bypass. Success rates for these approaches are high.

Acid reflux is relatively common after adjustable gastric banding, and 1 prospective trial showed that acid regurgitation increased from 13% to 69% after band placement, and the prevalence of postoperative esophagitis was as high as 75%.[41] Vertical banded gastroplasty was not related to increased acid reflux in the trial; however, other studies have shown this to be a problem. For patients with reflux or hiatal hernia before surgery, a combination of an antireflux procedure and banding has been shown to be effective.[42,43] For patients who develop GERD symptoms after band placement, antireflux procedures have been used with some success; however, conversion to RYGB is usually the favored approach to this problem because it effectively treats reflux and promotes further weight loss. With the exception of staple-line breakdown, acid reflux is rarely seen after gastric bypass (Fig. 4). Bile reflux should also be considered when reflux symptoms are present. This is particularly common with short limbs. Initial therapy is sucralfate combined with acid suppression.[44-46] If esophagitis persists, surgical revision may be considered, including lengthening of the Roux limb or enteroenterostomy.

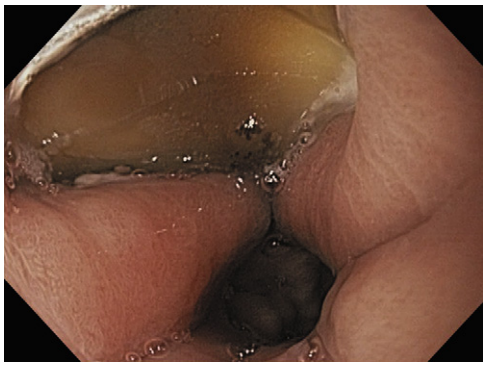

Figure 3. Erosion of a Lap-Band into the stomach.

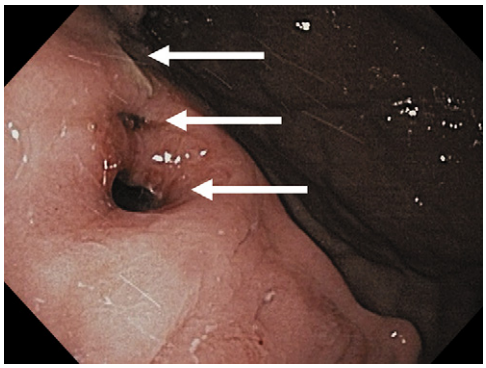

Figure 4. Staple-line breakdown. The *arrows* point to 3 small gastrogastric fistulae in a linear pattern along the staple line. As the breakdown progresses, these fistulae may increase in quantity and diameter.

Right upper quadrant pain in the postoperative patient must be thoroughly evaluated. Rapid postoperative weight loss creates a lithogenic state and is associated with an increased risk of cholelithiasis. The exact mechanism remains unknown but is thought to be caused by increased bile mucin content and bile calcium concentration in gallbladder bile during periods of weight loss.[47] The standard evaluation applies, with less-invasive testing such as US and MRCP being performed early. Laparoscopic cholecystectomy is considered safe and effective in the patient who has undergone bypass surgery. ERCP is fairly straightforward in patients with gastric banding and vertical banded gastroplasty. However, ERCP can be particularly challenging in gastric bypass patients because retrograde examination may be impossible in long Roux limbs. First attempts to pass the duodenoscope retrograde into the duodenum often fail. It may be possible to perform the procedure through an end-viewing instrument or a stiff guidewire may be placed by using an enteroscope or pediatric colonoscope, and the duodenoscope may then be passed over the wire (Fig. 5). If these measures are unsuccessful, access to the duodenum may be gained via a surgical or radiologically guided gastrostomy.[48] Another method of gastric access involves the use of a double-balloon enteroscope to place a retrograde PEG in the

Figure 5. ERCP performed in a post-RYGB patient by using an enteroscope.

defunctionalized stomach and then perform ERCP through the retrograde PEG.[49,50] After approximately 3 weeks of maturation, the gastrostomy may be dilated to allow passage of the duodenoscope. This is often painful; therefore, anesthesia support is typically recommended. Alternatively, immediate laparoscopy-assisted ERCP may be performed in the operating room via gastric trochar placement if urgent intervention is needed.[51-54]

The concern for postoperative biliary disease has resulted in many combined procedures with cholecystectomy at the time of bariatric surgery; however, this is becoming less common. Postoperative bile leaks are a considerable challenge in the patient who has undergone bypass surgery, because ERCP is unsafe in the immediate postoperative period and the lack of intrahepatic dilation makes the transhepatic approach very difficult. Ursodeoxycholic acid can help prevent gallstone formation, with a reported incidence reduction of 30% compared with placebo and should be considered in patients who have not undergone cholecystectomy.[55-57]

GI bleeding after bariatric surgery may result from esophagitis or ulceration that has occurred as a consequence of the altered anatomy. The standard gastric bypass anatomy allows a thorough evaluation of the esophagus, pouch, and jejunum. The bypassed stomach and duodenum are considerably more difficult to investigate. An enteroscope is usually required to traverse the Roux-en-Y, and success rates depend on the length of the Roux and afferent limbs. For limbs less than 100 cm in length, it is possible to traverse the jejunojejunostomy and enter the distal stomach in a retrograde manner in 25% of patients.[58,59] In patients with longer limbs, the success rate decreases dramatically. There is no evidence that long limbs are related to better outcomes, and they are often problematic when a thorough endoscopic evaluation is required. Fortunately, bleeding from the distal stomach remnant is unusual. If the bypassed stomach and duodenum require investigation, some endoscopists have reported using prototype endoscopic guides to reduce looping, whereas others have used double-balloon endoscopy to achieve visualization of the necessary anatomy.[60-62]

Blood counts, transferrin saturation, and ferritin are often monitored postoperatively because iron and vitamin B malabsorption may be seen after gastric bypass. It is important to exclude intraluminal pathology as a potential cause of postoperative iron-deficiency anemia. Upper endoscopy should be performed to evaluate possible erosive esophagitis, anastomotic ulcers, and pouch gastritis. Colonoscopy should be considered to exclude neoplasia. Low-volume preparations should be used because the higher volume agents are often not tolerated. If the results are negative, retrograde examination of the distal stomach and duodenum, when possible, may be helpful. This is a cumbersome procedure and typically requires an enteroscope or pediatric colonoscope.

Failure to lose weight after bariatric surgery may be attributable to several factors. Conversion to soft calories can be a problem for purely restrictive procedures; however, this is less likely with bypass procedures. If surgical failure is thought likely, an upper GI series should be performed to investigate possible staple-line disruption, pouch dilation, or band slippage. This is often followed by upper endoscopy to better visualize the mucosa and clarify abnormalities.

Staple-line disruption with resultant a gastrogastric fistula is reported in 4% to 29% of Roux-en-Y gastric bypass patients; however, many cases may remain subclinical, and the true incidence is not entirely clear.[21] Several factors, in addition to suboptimal weight loss, should increase suspicion for gastrogastric fistulae including acid reflux, abdominal pain, nausea, and marginal ulceration. The mainstay of treatment is surgery, with a reported complication rate nearly twice as high as that of the primary surgical procedure (15% morbidity, 0.7% mortality). Recently, new endoscopic suturing, clipping, and injectable therapies have been performed.[63] Fibrin glues have been used with some success to prevent suture line breakdown and have also been used in the treatment of postoperative gastrocutaneous fistulae.[64-66] Endoscopic suturing has been used to close staple-line dehiscence with a intragastric fistula and seems to be technically feasible; however, long-term durability is currently suboptimal for larger defects.[36,67] Additionally, endoscopic suturing has been used to successfully manage weight regain in patients with a dilated gastric pouch or stoma via volume reduction procedures (Fig. 6).[68]

Unlike chronic gastrogastric fistulae, gastric pouch leaks occur in the immediate postoperative setting and are life-threatening. The reported incidence ranges from 0% to 5.6% of cases.[30,69] Initial steps involve treatment

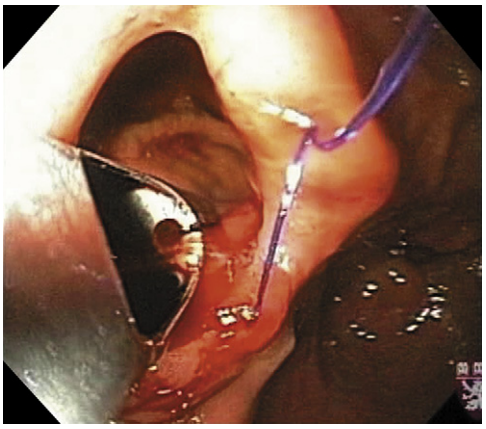

Figure 6. Endoscopic suturing of a gastrogastric fistula. The metallic endoscopic suturing device is visualized here placing nonabsorbable polypropylene suture along the rim of the fistula in an effort to attain closure.

of sepsis and supportive care, including total parenteral nutrition and transcutaneous drainage catheter placement. Some leaks may resolve with these conservative initial steps. Patients who do not stabilize with supportive care require operative exploration. Of the patients who survive the acute leak, some develop persistent leakage, resulting in a protracted hospital course and gradual clinical deterioration. Chronic leaks have been successfully repaired endoscopically by using a combination of techniques including mucosal ablation, clip placement, gluing, luminal stent placement, and stenosis dilation.[70]

CONCLUSION

As the obesity epidemic persists, the number and variety of surgical interventions continue to increase. As a result, GI complications are being seen with greater frequency, and clinicians must be well informed about the endoscopic management of the postbariatric surgery patient. Additionally, the development of new endoscopic devices, such as advanced suturing systems and biological agents, will likely broaden endoscopic applications, thereby reducing the need for surgical revision. These new endoscopic devices may also lead to less-invasive alternatives in the primary treatment of morbidly obese patients.

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