Complications of Laparoscopic Roux-en-Y Gastric Bypass

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KEYWORDS
- Bariatric surgery • Gastric bypass • Complications • Obesity

Morbid obesity is rapidly becoming a difficult to control epidemic and one of the most alarming public health problems in the United States. In 2007, approximately 200,000 bariatric surgical procedures were performed in the United States, with gastric bypass being the most common. With the advancement and use of minimally invasive techniques, laparoscopic Roux-en-Y gastric bypass (RYGB) has been performed in increasing volume. Since the first published case series in 1994, multiple studies have demonstrated the feasibility and safety of laparoscopic RYGB.

Laparoscopy has revolutionized bariatric surgery worldwide. Prospective randomized studies have shown that laparoscopic RYGB results in less blood loss, pain, medication requirements, shorter return to daily activities, and fewer complications than the open approach. Morbidly obese patients usually present with associated comorbidities at the time of evaluation and surgery. They are considered high-risk patients and should be evaluated thoroughly before their operation using a multidisciplinary team approach to select appropriate candidates. Laparoscopic RYGB remains one of the most advanced laparoscopic procedures currently performed worldwide. In an effort to overcome the steep learning curve, formal fellowship training or prolonged monitoring is required by most centers to achieve good outcomes. In an effort to minimize postoperative morbidity and mortality and improve outcomes, “Center of Excellence” designations were developed by credentialing organizations. Nonetheless, laparoscopic RYGB is still associated with a unique set of postoperative complications and a risk of mortality. Therefore, patients must be educated about these possible complications and potential adverse outcomes. The same skills, knowledge, and experience needed to perform the surgery are also required to manage these complications.
VENOUS THROMBOEMBOLISM

Deep venous thrombosis (DVT) and pulmonary embolism (PE) are infrequent but potentially fatal complications, and are two of the most feared causes of morbidity and mortality after any bariatric surgical procedure. Venous thromboembolism (VTE) continues to be one of the top two causes of mortality in bariatric patients. PE is the most common unexpected cause of death in the morbidly obese patient population and can occur anytime in the immediate or delayed postoperative period.

No formal consensus or FDA-approved protocol exists for appropriate VTE prophylaxis in patients undergoing bariatric surgery. Obesity is considered an important risk factor for perioperative DVT, and most bariatric surgeons routinely use some form of thromboprophylaxis. The overall reported incidence of DVT/PE in this population ranges from 0.12% to 3.8%. The prevalence of asymptomatic DVT in this group is undetermined. On postmortem evaluation, Melinek and colleagues found microscopic evidence of PE in 80% of patients who underwent gastric bypass, whereas 20% were diagnosed clinically.

Morbidly obese patients often have multiple risk factors that can increase the incidence of VTE, including a sedentary lifestyle with significant history of degenerative disc and/or joint disease, and some are confined to a wheelchair. Obesity hypoventilation syndrome, with its associated hypoxemia and hypercarbia, can be another major predisposing factor. A history of peripheral venous insufficiency and moderate to severe venous stasis are also not uncommon. Smoking, older age, use of oral contraceptives, and obesity may increase the risk of VTE. Any combination of these risk factors, along with general anesthesia, abdominal surgery, long operating time, increased intra-abdominal pressure from carbon dioxide insufflation, and decreased femoral venous flow, can drastically increase the risk for VTE. Large multicenter trials are needed to formalize optimal preoperative and postoperative VTE prophylaxis recommendations. Currently, surgeons nationwide are depending on unpublished and experience-based data for management. Several approaches have been proposed to reduce the incidence of perioperative DVT in morbidly obese patients, including early ambulation, antiembolic stockings, intermittent pneumatic compression devices, and chemoprophylaxis, such as subcutaneous and intravenous unfractionated heparin (UFH) or low-molecular-weight heparin (LMWH). DVTs and PEs still occur despite widespread use of prophylaxis. Although almost all surgeons advocate the use of sequential compression devices, many also add chemoprophylaxis.

The choice and timing of chemoprophylaxis are still debatable. Most advocates for postoperative chemoprophylaxis continue administration while patients are in the hospital, but fewer continue treatment after discharge. In contrast, others have reported good outcomes among patients not given chemoprophylaxis. In the author’s practice, all patients wear sequential compression devices during the procedure and while in the hospital when not ambulatory. They receive 5000 international units of subcutaneous UFH preoperatively, and three times per day postoperatively until discharge. Data from the author’s institution has shown a lower risk of postoperative bleeding with UFH compared with LMWH. Extended chemoprophylaxis is reserved for patients who are at higher risk (ie, history of VTE). Inferior vena cava filters are considered for patients with a history of recurrent DVTs while on anticoagulation, previously documented PE, and/or the presence of a hypercoagulable disorder.

ANASTOMOTIC LEAKS

Anastomotic leaks (ALs) can be defined as inadequate tissue healing allowing for exit of gastrointestinal material through the staple or suture line. They are among the most
feared and potentially devastating complications after laparoscopic RYGB, and are associated with a high morbidity and mortality. The incidence of this complication ranges from 0 to 5.6% in large series and does not differ significantly between laparoscopic and open RYGB.\textsuperscript{15}

ALs remain the second leading cause of death after RYGB surgery,\textsuperscript{16} and together with PEs account for more than 50% of the causes of death in patients undergoing bariatric surgery. Previous studies have reported mortality after AL to be as high as 37.5%.\textsuperscript{15}

ALs can occur at five potential sites after laparoscopic RYGB; at the gastrojejunos-tomy, gastric pouch staple line, gastric remnant staple line, Roux limb staple line, and jejunojejunostomy. Clinical studies have identified several potentiating factors, both technical and patient-related.\textsuperscript{15-17} Patients at higher risk are primarily those who are older super-obese, men, and those with multiple comorbidities and previous or revisional bariatric operations. Operative technique, including appropriate staple sizing, staple line reinforcement with biologic buttress material,\textsuperscript{18} use of fibrin sealant,\textsuperscript{19} intraoperative leak testing, anastomosis under tension, and ischemia can affect the incidence of ALs after laparoscopic RYGB.\textsuperscript{20} Although most ALs occur 5 to 7 days after surgery and are thought to be related to ischemia, 95% of ALs that occur within 2 days of surgery probably result from technical error.\textsuperscript{21} Choosing the appropriate staple height and inspecting the stapling devices and staple line for integrity and perfusion after firing are essential to minimize ALs. Another important factor in anastomotic integrity is creating a tension-free anastomosis. Anastomotic tension has been proposed as a risk factor for ALs after gastric bypass surgery because it may result in stress that exceeds the disruptive pressures of a stapled or sutured anastomosis. One technical factor that has been studied and reported is the role of Roux limb orientation in the development of ALs after laparoscopic RYGB. Theoretically, compared with the antecolic route, the retrocolic Roux limb has a more direct path to the gastric pouch and may be associated with lower gastrojejunal anastomotic tension. Although a prospective randomized study is still needed to prove this theory, a few studies have reported conflicting results. Edwards and colleagues\textsuperscript{22} reported that ALs may occur more commonly after antecolic (3%) versus retrocolic (0.5%) laparoscopic RYGB. However, Bertucci and colleagues\textsuperscript{23} reported no ALs after 141 retrocolic and 200 antecolic procedures, and Carrasquilla and colleagues\textsuperscript{24} reported an AL rate of 0.1% after 1000 antecolic procedures versus 1.85% after 108 retrocolic procedures.

Diagnosis of an AL relies on a high index of clinical suspicion. Patients developing an AL will most likely require multiple diagnostic tests, prolonged hospitalization, intensive care settings, and operative interventions. A patient who does not progress favorably after the first postoperative day and experiences increasing abdominal pain, persistent tachycardia, fever, tachypnea, or any combination of these symptoms requires investigation. Radiographic findings such as fluid collections adjacent to the pouch, diffuse abdominal fluid, free intraperitoneal air, and trace amount of oral contrast in the drain tract can confirm the diagnosis.

Conservative management can be effective in nonseptic, hemodynamically stable patients with contained ALs that are accessible percutaneously, but others require reexploration, primary repair if possible, and adequate drainage. In many instances, the repair of ALs may not be feasible, especially if acute inflammatory changes are present around the gastrojejunostomy and adequate drainage is the only practical intervention. Surgical exploration is warranted in hemodynamically unstable patients. Many bariatric surgeons practice the routine use of drains after laparoscopic RYGB. Drains positioned near the gastrojejunostomy may be useful for detecting early and
small-volume ALs or bleeding. Drain output may prompt surgeons to take preventive measures, such as discontinuing anticoagulation and initiating early fluid resuscitation. Abdominal drains placed during the initial procedure may prevent collections and allow early diagnosis, resulting in effective control of leaks and fewer indications for early surgical treatment.

Some studies have reported very good outcomes with conservative management of gastrojejunostomy, excluded stomach, and pouch leaks. A conservative approach requires adequate drainage, broad-spectrum antibiotics, and nutritional support. Enteral nutrition through a gastrostomy tube in the excluded stomach is preferred over total parenteral nutrition when possible. Endoscopic injection of fibrin sealant in controlled gastrojejunostomy ALs has also been anecdotally reported with variable success.

GASTROINTESTINAL BLEEDING

The incidence of gastrointestinal bleeding (GIB) after laparoscopic RYGB has been reported to be between 1.1% and 4%. Although its incidence is low, GIB can be life-threatening if not recognized and treated early. Podnos and colleagues reported a higher rate of GIB after laparoscopic RYGB compared with open RYGB (1.9% vs 0.6%, respectively). The increased incidence of GIB post-RYGB in the minimally invasive surgery era can be explained partly by the decreased practice of oversewing the staple lines and the overuse of DVT chemoprophylaxis. GIB after laparoscopic RYGB can originate at one of five potential staple lines: the gastric pouch, excluded stomach, Roux limb staple line, gastrojejunostomy, and jejunojejunostomy. Bleeding from these sites can be intraperitoneal or intraluminal. Staple-line bleeding occurs at the transected tissue edges or at the sites of staple penetration of the tissue. Additional sites of bleeding include the liver, spleen, and trocar sites.

Recognizing the clinical signs and symptoms of GIB is crucial in determining the most appropriate steps for managing this life-threatening complication. Primary treatment depends on the timing of onset and the clinical presentation. The presence of pallor, dizziness, confusion, tachycardia, hypotension, hematemesis, bright red blood per rectum, and low urine output should alert the surgeon to ongoing postoperative bleeding that might necessitate urgent reexploration. Early postoperative bleeding, occurring within a few hours after the procedure, manifested by hematemesis or bright red blood per rectum in the presence of clinical signs of bleeding is a clear indication for urgent surgical intervention. Late presentation of GIB (>48 hours) after laparoscopic RYGB can be conservatively managed in most cases, especially when associated with no acute clinical symptoms, and melena, which might indicate the passage of old blood and inactive bleeding. Discontinuation of DVT chemoprophylaxis and watchful waiting with supportive therapy can be successful in most of these cases. Although hematemesis suggests a gastrojejunostomy origin, brisk, bright red blood per rectum might originate from the gastric remnant or jejunojejunostomy anastomosis.

A substantial amount of blood can be lost with an acute postoperative gastrointestinal hemorrhage before overt clinical abdominal signs develop. When intra-abdominal bleeding is suspected based on systemic clinical signs, such as hypotension, tachycardia, or a falling hematocrit, in the absence of any obvious GIB source, reexploration should not be delayed. Interventions are dictated by the timing and clinical scenario of the GIB. A proximal intraluminal GIB is best addressed by endoscopic intervention, which is invaluable in controlling bleeding from the gastric pouch or gastrojejunostomy. Thermal coagulation, injection of vasoconstrictors, and clipping are all effective ways of controlling bleeding from these sites. Endoscopy is a less-effective means of
managing a jejunojejunostomy bleed because of difficult accessibility. Reexplorations can be performed either laparoscopically or via open surgery, depending on the patient’s hemodynamic status. In unstable patients, laparoscopy is a relative contraindication, because the increased intra-abdominal pressure during pneumoperitoneum can result in worsening hemodynamics. During reoperations, other potential bleeding sites, such as the excluded stomach, can be examined and the staple lines oversewn if needed. Finding a dilated excluded stomach, filled with thrombus, necessitates evacuation and gastric tube placement for continuous decompression. Not infrequently, no obvious source of bleeding can be determined during reexplorations, but the patient can still benefit from the evacuation of intraperitoneal hematoma, which might speed the recovery process through shortening the duration of postoperative ileus.

Use of appropriate staple heights and staple-line reinforcement with buttressing material are methods that have been advocated for decreasing the occurrence of GIB after laparoscopic RYGB. Choice of chemoprophylaxis regimen may also influence GIB rates. Data from the author’s institution has shown that UFH for DVT chemoprophylaxis was associated with a decreased risk for postoperative bleeding compared with enoxaparin. Routine drain placement after laparoscopic RYGB can serve as an adjunct in diagnosing early intraperitoneal bleeding. Chousleb and colleagues concluded that drain output may alert surgeons to take preventive measures for a suspected bleed, such as discontinuing anticoagulation and initiating early fluid resuscitation.

INTERNAL HERNIA AND INTESTINAL OBSTRUCTION

Internal Hernia

In the laparoscopic era, internal hernia is a feared and well-recognized complication after RYGB. An internal hernia can be defined as a protrusion of intestine through a defect within the abdominal cavity. Most internal hernias present later in the postoperative period rather than early. Compared with the open approach, the incidence of internal hernia is greater after laparoscopic RYGB, estimated between 3% and 4.5%. Investigators have postulated that laparoscopic RYGB results in fewer postoperative adhesions, and therefore reduced fixation of small intestine to adjacent structures. In addition, rapid weight loss after laparoscopic RYGB results in reduced intraperitoneal fat and larger mesenteric defects. An internal hernia can lead to clinically significant complications, such as a closed loop bowel obstruction with or without strangulation. It is considered the most common cause of small bowel obstruction (SBO) after laparoscopic RYGB. Internal hernias typically occur at three potential locations: the jejunojejunostomy mesenteric defect, Petersen’s space, and transverse mesocolic defect in the retrocolic approach (Fig. 1). In general, the Roux limb configuration plays a major role in determining the type of hernia. The most common location for internal hernias and its relation to Roux limb configuration has been a subject of debate, with no consensus thus far. Understandably, mesocolic defect hernias are unique to a retrocolic approach and are not seen with an antecolic approach. In some reports, mesocolic defects were the most common among all internal hernias. Garza and colleagues reported that transverse mesocolic hernias were the most common, followed by jejunojejunostomy and Petersen’s space hernias. In an antecolic approach, however, both Petersen’s and jejunojejunostomy mesenteric defect hernias are reported, with hernias at the jejunojejunostomy defect being more common in some series. Other investigators report a higher incidence of Petersen’s and jejunojejunostomy hernias with a retrocolic approach. Champion and Williams reported a significant decrease in SBO after switching from a retrocolic to an antecolic technique.
Intestinal Obstruction

Abdominal pain with or without intestinal obstruction is the most common presentation of an internal hernia. Usually the presentation is delayed, occurring several months to years after the operation, but it can occur in the immediate postoperative period. Some patients report previous episodes of undefined gastrointestinal upset and frequent mild symptoms of self-limited intestinal obstruction before their main presentation. The small bowel may intermittently become trapped and then reduced at the site of the internal hernia, causing this subtle presentation and atypical bowel obstruction features. CT scanning is not always diagnostic, and therefore any patient with unexplained abdominal pain that does not correlate with physical findings should be considered to have an internal hernia. A high index of suspicion is crucial for early intervention and avoidance of an abdominal catastrophe, such as long segment of small bowel ischemia. Gandhi and colleagues suggested that SBO from an internal hernia after laparoscopic RYGB is typically preceded by symptoms of intermittent obstruction. Patients who have these symptoms should be promptly offered elective laparoscopic exploration.

Other intraoperative factors besides the Roux limb configuration, such as closure of all potential defects with a nonabsorbable running suture, have been suggested to influence the incidence of internal hernia. Some authors who have modified their technique from absorbable to nonabsorbable sutures and from an interrupted to...
a running technique have reported a reduction in the incidence of internal hernias.\textsuperscript{33} Hope and colleagues\textsuperscript{34} concluded that routine suture closure of mesenteric defects after laparoscopic RYGB may not be an effective permanent closure, likely because of the extensive loss of fat and weight loss within the mesentery. Some authors still report acceptable results when not closing mesenteric defects.\textsuperscript{35}

In the author’s practice, all laparoscopic RYGB procedures are performed with a retrocolic approach to create a tension-free gastrojejunostomy. All potential mesenteric defects are routinely closed with a running nonabsorbable suture. The rate of internal hernias at the author’s institution is comparable to that reported in literature.\textsuperscript{36}

The second most common cause of SBO after laparoscopic RYGB is obstruction at the jejunojejunostomy, occurring in approximately 1.8\% of antecolic laparoscopic RYGB procedures.\textsuperscript{37} It can also be a complication of the retrocolic approach. Early obstructions at the jejunojejunostomy can be caused by technical problems, such as bowel kinking, narrowing, or acute angulation of the anastomosis. Other causes include postsurgical anastomotic edema, stenosis, ischemia, and staple-line bleeding with intraluminal thrombus formation. Early SBOs at other locations usually result from edema or technical problems with the Roux limb position, such as an extrinsic compression of the Roux limb as it traverses the transverse mesocolic defect from thickened cicatrix formation in this area.\textsuperscript{38}

Other less-common causes of SBO after laparoscopic RYGB include trocar site incisional hernias, adhesive bands, bezoars, anastomotic strictures, and jejunojejunostomy intussusception. Rarely, superior mesenteric artery syndrome might complicate the course of laparoscopic RYGB secondary to rapid weight loss and cause gastric outlet obstruction symptoms.\textsuperscript{39}

**MARGINAL ULCERATIONS**

Marginal ulceration (MU) has been reported to be the most commonly found abnormality on endoscopy in symptomatic patients who underwent laparoscopic RYGB.\textsuperscript{40} It is diagnosed in 1\% to 16\% of patients.\textsuperscript{41} Most recent studies cite an incidence of around 2\%.\textsuperscript{42} Factors predisposing patients to MU have not been completely revealed, but the origin is likely multifactorial. Several factors, including pouch size and orientation, mucosal ischemia, staple-line disruption and gastrogastric fistula, foreign body reaction, exogenous substances, and \textit{Helicobacter pylori} infection, have been all implicated as potential causes. Other intrinsic factors, such as hormonal and metabolic, versus extrinsic factors, such as tobacco and nonsteroidal anti-inflammatory drug (NSAID) use have also been suggested.

Larger pouch size (>50 mL) and orientation have been thought to predispose patients to MU,\textsuperscript{43} and reducing its size has been shown to decrease its incidence.\textsuperscript{44} Sapala and colleagues\textsuperscript{45} found that creating a pouch limited to the cardia resulted in a 0.6\% MU rate at 3-year follow-up among 173 patients. Thus, larger pouch size was postulated early on to be correlated with increased acid production, leading to increased incidence of marginal ulcers.

A pathway in which less acid reaches the antrum, leading to excessive stimulation of antral gastrin-secreting cells and higher gastrin levels, has been proposed.\textsuperscript{46} Later investigators showed that little, if any, gastric acid is produced in the pouch.\textsuperscript{47} However, the significant decrease in acid secretion after gastric bypass may not be universal, as concluded by Mason and colleagues,\textsuperscript{48} who found that although gastric acid secretion is nearly absent in most patients after gastric bypass, 43\% of their study patients had a low pH within the pouch. Thus, even with smaller pouch sizes, MU
would be expected to occur despite the presumed absence of or decreased acid production.

A noteworthy finding was that serum gastrin levels were found to be universally low after gastric bypass.\textsuperscript{48} It seems that gastric acid secretion is primarily stimulated by gastrin in most obese patients, but in patients who continue to have low gastric pH after surgery, vagal innervation may be the primary stimulus for acid secretion, putting them at higher risk for MU. This role of acid secretion in developing MU is supported by evidence that acid suppression alone is effective in healing most MUs.\textsuperscript{41}

Another precipitating factor for MU after laparoscopic RYGB may be the prolonged irritation by foreign material, such as nonabsorbable sutures at the gastrojejunostomy. Sacks and colleagues\textsuperscript{49} reported their data comparing the incidence of MU associated with the use of nonabsorbable sutures versus absorbable ones. They found a significant decrease in incidence from 2.6\% to 1.3\%, respectively, in a study cohort of 3285 patients. Local ischemia has also been suggested as a cause of MU, although it might more commonly lead to the development of stricture formation. \textit{H pylori} is another contributing factor in the development of ulcer disease. Patients who present with upper gastrointestinal symptoms should undergo endoscopy before gastric bypass and should be treated if \textit{H pylori} is diagnosed. However, Papasavas and colleagues\textsuperscript{50} hypothesized and concluded that the prevalence of \textit{H pylori} in patients undergoing RYGB is similar to that in the general population, and that preoperative \textit{H pylori} testing and treatment does not decrease the incidence of anastomotic ulcer or pouch gastritis.

Tobacco use is also an important factor in the development of ulcer disease. Studies have shown significant compromise of the gastric mucosal barrier and impaired wound healing associated with smoking.\textsuperscript{51} Decreased tissue oxygenation has been proposed as the factor responsible for the impaired wound healing. It is important to remember that the jejunum, unlike the native duodenum, does not possess an innate acid buffer, and this is probably the most important contributor to the development of MU at the gastrojejunostomy. In the era of minimally invasive bariatric surgery, staple-line disruption and gastrogastric fistula are encountered less frequently with the introduction of new stapling techniques and complete division/separation of the excluded stomach and gastric pouch staple lines.

Timing and presentation of MU after laparoscopic RYGB vary widely. One early study by Møller and colleagues\textsuperscript{52} suggested that most ulcers developed in the first 3 months postoperatively, with a continued, lower risk up to 1 year. Another group reported a mean of 48 days (around 7 weeks) for the development of MU.\textsuperscript{53} Nausea and vomiting may be common presenting complaints in patients with MU. Endoscopic evaluation, especially in the presence of epigastric pain and dysphagia, should be considered. In addition to MU, postoperative endoscopy for symptoms after laparoscopic RYGB may also reveal stenosis of the gastrojejunostomy or a gastrogastric fistula. Late presentation of GIB at the gastrojejunostomy is most commonly associated with MU.\textsuperscript{54}

Treatment is primarily medical, consisting of antisecretory therapy with proton pump inhibitors (PPIs) and sucralfate, except in the presence of a gastrogastric fistula wherein surgery is warranted. When diagnosed, most cases of MU will respond to PPI, H2-blockade, or sucralfate therapy.\textsuperscript{55} If not treated promptly, MU may lead to stricture formation and gastric pouch outlet obstruction, which will require endoscopic dilation. Unlike the more common peptic ulcers, these lesions tend to require prolonged therapy, usually for 3 to 4 months, and repeat endoscopy is recommended to confirm ulcer resolution. An attempt should be made to identify the causative factor if present, such as NSAID use, smoking, or a remnant suture, which should then be managed
accordingly. Occasionally, revision of the gastrojejunostomy anastomosis will be required for patients with persistent symptoms and ulceration despite aggressive medical therapy.

**ANASTOMOTIC STRICTURES**

Gastrojejunal anastomotic stricture is one of the most commonly occurring complications after laparoscopic RYGB. It is reported in 5% to 27% of cases, typically within 90 days after surgery. Clinically, it manifests through persistent or worsening post-prandial vomiting with or without pain. Although the origin of stricture formation is unclear, the possible mechanisms include ischemia causing scarring, nonischemic excessive scar formation, recurrent MU, tension or malposition of the anastomosis, and surgical technique. Causative technical factors that might contribute to increased stricture formation are type of stapler used (circular vs linear), stapler size, hand-sewing, and surgeon experience.

Circular staplers offer surgeons a reproducible anastomosis, which eliminates any technique-dependent variability that might make it difficult to scientifically assess the effect of anastomotic size on incidence of stenosis and on the eventual weight loss resulting from gastric bypass surgery. This fact was the basis of many studies designed to assess the effect of the diameter on long-term anastomotic patency. Fisher and colleagues prospectively compared the incidence of gastrojejunostomy stenosis in laparoscopic RYGB using a 21- versus 25-mm circular stapler. They reported that the 29.6% increase in lumen with the 25-mm stapler compared with the 21-mm stapler significantly decreased stenosis rates by one-half, and significantly delayed the onset of symptoms. Nguyen and colleagues reported a 26.8% incidence of strictures after laparoscopic RYGB using a 21-mm circular stapler (which gives an internal diameter of 11 mm) compared with 8.8% using the a 25-mm circular stapler (which gives an internal diameter of 15 mm).

In contrast, Frutos and colleagues reported a 3.4% incidence of stenosis with the use of 21-mm circular staplers. They argued that restrictive procedures fail when the stoma is too wide. Therefore, they advocated the use of a 21-mm stapler instead of the 25-mm stapler, because the stapler is less difficult to insert through the abdominal wall and small intestine, but, more importantly, because the small diameter of the anastomosis delays gastric pouch emptying and consequently increases weight loss in the long-term.

Gonzalez and colleagues previously published their results of a comparative study of the circular mechanical anastomosis versus a hand-sewn anastomosis, noting a significant increase in stenosis rates in the circular stapler group (31% vs 3%). Routine performance of early postoperative upper gastrointestinal series (UGIS) would not seem to help predict the occurrence or progression to strictures. Daylami and colleagues reported that a positive UGIS is 100% specific for the presence of stricture, whereas its sensitivity and negative predictive value is poor, making it unsatisfactory in definitively excluding the diagnosis. However, a possible role in predicting better postoperative weight loss in patients showing normal early gastric emptying has been reported. Note that MU may also produce the same clinical symptoms of stenosis and can even be the cause.

Endoscopy, therefore, is considered the preferred diagnostic procedure and has the added benefit of being therapeutic. Several studies have shown that endoscopic balloon dilation is the first line of treatment. Findings have shown that 17% to 67% of cases responded to the first dilation, whereas 3% to 8% of cases required three or more dilations. Early endoscopy and gentle dilatation are warranted once
appropriate symptoms are suspected. Late scarring and fibrosis at the anastomotic stricture would be a prohibitive factor and put the patient at increased risk of perforation during balloon dilatation.

SUMMARY

Despite the well-documented safety of laparoscopic RYGB, several short-term and long-term complications, with varying degrees of morbidity and mortality risk, are known to occur. Bariatric surgeons, all too familiar with these complications, should be knowledgeable in risk-reduction strategies to minimize the incidence of complication occurrence and recurrence. Bariatric and nonbariatric surgeons who evaluate and treat abdominal pain should be familiar with these complications to facilitate early recognition and intervention, thereby minimizing the associated morbidity and mortality.

REFERENCES


