Communication from the ASGE Standards of Practice Committee

GUIDELINE

Role of endoscopy in the bariatric surgery patient

This is one of a series of statements discussing the utilization of GI endoscopy in common clinical situations. The Standards of Practice Committee of the American Society for Gastrointestinal Endoscopy (ASGE) prepared this text. In preparing this guideline, MEDLINE and PubMed databases were used to search for publications from the last 15 years that are related to endoscopy by using the keyword "endoscopy" and each of the following: "bariatric," "obesity," "gastroplasty," "gastric bypass," "Roux-en-Y," and "weight loss." The search was supplemented by accessing the "related articles" feature of PubMed with articles identified on MEDLINE and PubMed as the references. Pertinent studies published in English were reviewed. Studies or reports that described fewer than 10 patients were excluded from analysis if multiple series with more than 10 patients that addressed the same issue were available. The resultant quality indicators were adequate for analysis. The reported evidence and recommendations based on reviewed studies were graded on the strength of the supporting evidence (Table 1).

Guidelines for appropriate utilization of endoscopy are based on a critical review of the available data and expert consensus. Further controlled clinical studies may be needed to clarify aspects of this statement, and revision may be necessary as new data appear. Clinical consideration may justify a course of action at variance to these recommendations.

BACKGROUND

Obesity in the United States is a major health problem that contributes to increased morbidity and mortality and to a host of disease processes.[1,2] Body mass index (BMI) is calculated as weight/height^2 (kg/m^2) and is commonly used to classify overweight (BMI 25.0-29.9 kg/m^2) and obese (BMI $\geq$ 30.0 kg/m^2) adults. Based on data obtained from the National Health and Nutrition Examination Survey from 2003 to 2004, 61% of adults over the age of 20 years in the United States are overweight or obese, 32.2% are frankly obese, and 4.8% had a BMI $\geq$ 40 kg/m^2.[3] Furthermore, several studies showed that obesity is associated with an increased risk for morbidity and all-cause mortality.[4-7] In recognition of these risks and the evidence for risk reduction associated with weight loss,[8] the National Institutes of Health has recommended weight loss surgery as an appropriate alternative in carefully selected individuals with severe obesity (BMI $\geq$ 40 kg/m^2 or those with a BMI $\geq$ 35 kg/m^2 and with serious comorbid conditions) when dietary, behavioral, and pharmacotherapy interventions failed.[9]

Bariatric surgery results in durable and significant weight loss. The rising prevalence of obesity and the success of surgical interventions led to a marked increase in the number of weight-loss surgeries performed in the United States, from 13,365 in 1998 to 102,794 in 2003.[10] Early bariatric surgical techniques (eg, jejunoileal bypass) are no longer performed because they resulted in clinically significant and serious vitamin deficiencies, steatohepatitis, and even cirrhosis in some patients.[11] Instead, various procedures that cause weight loss through volume restriction, limited malabsorption and maldigestion, behavioral modification, or some combination thereof were developed. The most commonly used bariatric surgeries are laparoscopic or open Roux-en-Y gastrojejunal bypass (RYGB) and laparoscopic adjustable gastric banding (LAGB).[10,12] Other surgeries include vertical banded gastroplasty (VBG), and sleeve gastrectomy alone or with duodenal switch and biliopancreatic diversion (DS/BPD). It is useful to understand the anatomical alterations created by these operations as they pertain to the mechanisms for weight loss (Table 2, Figs. 1-3), expected complications, and considerations for endoscopic evaluation.

EVALUATION OF THE PREOPERATIVE PATIENT

The role of upper endoscopy in the preoperative evaluation of patients undergoing bariatric surgery may be based, in part, on the presence or absence of symptoms. The performance of an upper endoscopy in a patient with reflux symptoms, dysphagia, and/or dyspepsia has been covered in recent guidelines and is equally relevant in the preoperative patient.[13,14] However, because RYGB and DS/BPD render the distal stomach and/or duodenum inaccessible by a standard upper endoscope, the threshold for performing a preoperative endoscopic evaluation of the upper-GI tract is lower than for other surgeries.

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TABLE 1. Grades of recommendation*

Grade of recommendation	Clarity of benefit	Methodologic strength supporting evidence	Implications
1A	Clear	Randomized trials without important limitations	Strong recommendation; can be applied to most clinical settings
1B	Clear	Randomized trials with important limitations (inconsistent results, nonfatal methodologic flaws)	Strong recommendation; likely to apply to most practice settings
1C+	Clear	Overwhelming evidence from observational studies	Strong recommendation; can apply to most practice settings in most situations
1C	Clear	Observational studies	Intermediate-strength recommendation; may change when stronger evidence is available
2A	Unclear	Randomized trials without important limitations	Intermediate-strength recommendation; best action may differ depending on circumstances or patients' or societal values
2B	Unclear	Randomized trials with important limitations (inconsistent results, nonfatal methodologic flaws)	Weak recommendation; alternative approaches may be better under some circumstances
2C	Unclear	Observational studies	Very weak recommendation; alternative approaches likely to be better under some circumstances
3	Unclear	Expert opinion only	Weak recommendation; likely to change as data become available

**Adapted from* Guyatt G, Sinclair J, Cook D, et al. Moving from evidence to action. Grading recommendations: a qualitative approach. In: Guyatt G, Rennie D, editors. Users' guides to the medical literature. Chicago: AMA Press; 2002. p. 599-608.

TABLE 2. Mechanism of weight loss for common obesity surgeries

Procedure	Mechanism
VBG	Restrictive (Fig. 1A)
LAGB	Restrictive (Fig. 1B)
RYGB	Restrictive/maldigestive/behavioral modification (Fig. 1C)
Sleeve gastrectomy	Restrictive (Fig. 2)
DS/BPD	Restrictive/maldigestive (Fig. 3)

The rationale for performing an EGD before bariatric surgery is to detect and/or treat lesions that might potentially affect the type of surgery performed, cause complications in the immediate postoperative period, or result in symptoms after surgery. In particular, a recent meta-analysis showed that obesity was associated with a significantly increased risk of GERD, erosive esophagitis, and esophageal adenocarcinoma.[15] The value of a routine endoscopy before bariatric surgery in the patient without symptoms remains controversial because of limited observational studies in this group. However, the presence of a large hiatal hernia represents a relative contraindication to LAGB because of an increased risk for band slippage.[16] In addition, some surgeons advocate crural tightening in patients with a hiatal hernia when these patients are undergoing any weight loss operation.[17]

Multiple studies have been published that demonstrate that routine endoscopy before LAGB,[18,19] VBG,[20] and Roux-en-Y can identify a variety of pathologies, including hiatal hernia, esophagitis, and gastric ulcers. The majority of patients with pathology in these studies were asymptomatic. Importantly, no malignancies were identified, although, in 2 studies, the endoscopic findings resulted in an alteration of the surgical approach or a delay in surgery.[21,22] Guidelines from outside the United States recommend preoperative upper endoscopy in all patients before bariatric surgery, regardless of the presence or absence of symptoms.[23] Although an upper endoscopy in patients without symptoms can identify lesions that may alter surgical management, there are no studies that evaluated the effect of a preoperative endoscopy on surgical outcome. Contrast studies may be an alternative to an endoscopy and can provide complementary information to an endoscopy.[24]

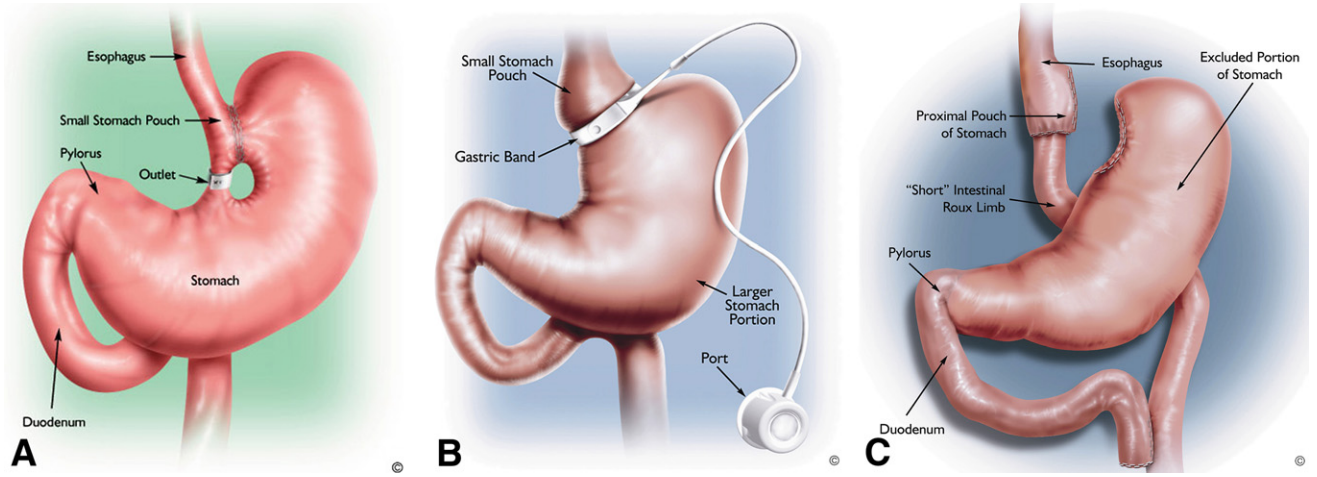

Figure 1. Illustrations of various weight loss surgeries. **A,** VBG. **B,** Laparoscopic adjustable gastric band. **C,** RYGB. (Courtesy Ethicon Endo-Surgery, Inc.)

Helicobacter pylori infection is present in 30% to 40% of patients scheduled for bariatric surgery, and preoperative testing in these patients may be useful.[22,25] In one study of patients without symptoms who were scheduled for an RYGB, the patients with a positive rapid urease test were significantly more likely to have an abnormal endoscopy than those who tested negative (94% vs 51%).[25] In another study, patients with *H pylori* infection were more likely to develop postoperative marginal ulcers.[22] In patients without symptoms and who were not undergoing an endoscopy, noninvasive *H pylori* testing, followed by treatment, if positive, is recommended.

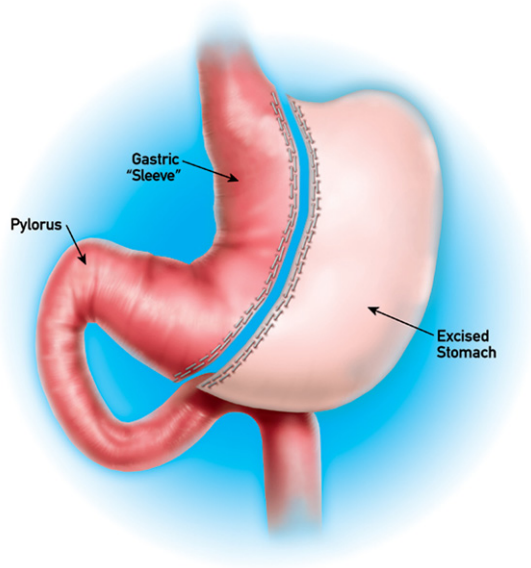

Figure 2. Illustration of sleeve gastrectomy. (Courtesy Ethicon Endo-Surgery, Inc.)

ENDOSCOPY IN THE POSTOPERATIVE PATIENT

General principles

When an endoscopy is considered in a patient who had bariatric surgery, the endoscopist should be aware of the operative procedure performed and the findings on preprocedural imaging studies, and must understand the expected anatomy, including the extent of resection and the length of surgically created limbs. Direct communication with the surgeon, if possible, is advisable. Feitoza and Baron[26] published a detailed review of endoscopy in patients with postsurgical anatomy, including information on the equipment needed for successful completion of diagnostic and therapeutic procedures, and tips on accessing the distant or excluded portions of the GI tract. The choice of endoscope will depend on the indication and the need for intubation of the excluded limb or therapeutic intervention (eg, ERCP). In patients who are in the early postoperative period, air insufflation may have potentially detrimental effects in the presence of leaks and/or tenuous anastomoses. If there is suspicion of a leak, then the endoscopist should consider contrast radiography as an initial diagnostic test. Contrast studies are complementary to an endoscopy and are also helpful in delineating anatomy.

The expected endoscopic findings after an RYGB include a normal esophagus and gastroesophageal junction. The size of the gastric pouch varies. Special care should be made to examine the pouch and suture line for fistulas and ulcerations. The gastrojejunal stoma should be carefully examined. The width of the anastomosis is generally 10 mm to 12 mm in diameter. Beyond the anastomosis, a short, blind limb is often visible alongside the efferent jejunal limb. The jejunojejunal anastomosis can sometimes be reached with an upper endoscope, depending on the length of the Roux limb. It should be noted that

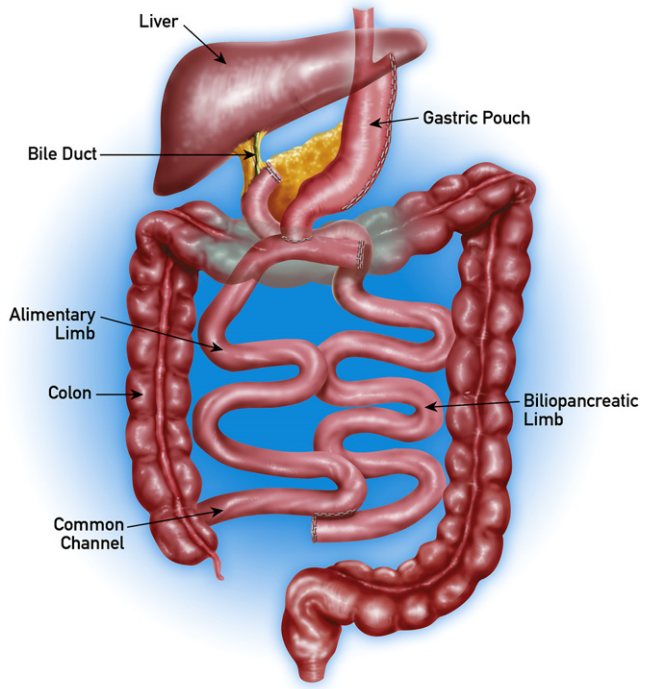

Figure 3. Illustration of DS/BPD. (Courtesy Ethicon Endo-Surgery, Inc.)

the length of the Roux limb after an RYGB can vary significantly from standard Roux limbs created for nonbariatric procedures and can range from 50 to 150 cm. The distal or excluded stomach cannot be visualized in the absence of a fistula with a regular gastroscope. A VBG produces a gastric pouch somewhat similar in appearance to an RYGB. The banded stoma is generally 10 to 12 mm in diameter, and, once traversed, the distal stomach and duodenum can be visualized.

The sleeve gastrectomy produces a long tubular stomach limited in expansion by a staple line that parallels the lesser curvature. The staple line should be examined for defects and ulcerations. The duodenal switch procedure is often performed in conjunction with a sleeve gastrectomy, but also includes a duodeno-jejunal anastomosis visible just distal to an intact gastric pylorus. In the latter, the ampulla is thus not available for visualization or ERCP in a standard fashion.

Laparoscopic adjustable gastric bands produce a variable amount of extrinsic circumferential compression on the proximal stomach that is evident on upper endoscopy. At the time of endoscopic evaluation, the endoscopist should note the length of the pouch as measured from the gastroesophageal junction to the impression of the band to assess for pouch dilatation or band slippage. The endoscopist should also evaluate for the possible presence of band erosion into the gastric wall.[27] There are a variety of symptoms and unique postsurgical complications after bariatric surgery (Tables 3 and 4). These will be discussed in the following sections.

TABLE 3. Signs and symptoms prompting possible endoscopic evaluation after bariatric surgery

Upper-GI symptoms
Nausea
Vomiting
Dysphagia
Pain
Reflux
Diarrhea
Anemia/bleeding
Weight regain

TABLE 4. Upper-GI postbariatric surgical complications

Marginal ulcers
Leaks/fistulas
Stricture
Bezoars
Band erosion and slippage
Choledocholithiasis

INDICATIONS FOR AN ENDOSCOPY IN THE PATIENT AFTER GASTRIC BYPASS OR WITH A PREVIOUS BYPASS

Symptoms

Nausea, vomiting, and abdominal pain are among the most commonly encountered symptoms after bariatric surgery and may result from one or several structural and functional etiologies. Symptoms are frequently associated with dietary noncompliance as to the volume and type of foods eaten, rapid ingestion, or inadequate chewing. Patients with persistent symptoms, despite counseling and behavior modification, should be evaluated, because these symptoms may indicate the development of marginal ulcers, gastrogastric fistulas, postsurgical reflux disease, or partial or complete anastomotic obstruction. An endoscopy is the preferred strategy, unless there is a suspicion of leaks or fistulas, when contrast radiography is more appropriate. Patient history may be helpful in differentiating the etiology of pain and in guiding the type of investigation. Nausea, vomiting, abdominal distention, and bloating alone or in conjunction with abdominal pain can suggest an obstructive cause, such as strictures, internal hernias, or bezoars, but may also be an indication of dumping syndrome. Also, dysphagia can result from esophageal dysmotility or

gastrojejunal anastomotic stenosis. In one study, 62% of patients who were seen with persistent nausea and vomiting and 30% of those who are seen with abdominal pain or dyspepsia after an RYGB had significant findings on upper endoscopy, including marginal ulcers, stomal stenosis, and staple-line dehiscence.[28]

Marginal ulcers

Marginal ulcers are typically seen 1 to 6 months after surgery and may present with abdominal pain, bleeding, or nausea, although they may also be asymptomatic.[28] The ulcers occur at the gastrojejunal anastomosis, usually on the intestinal side, and are thought to arise from a number of factors, including local ischemia, staple-line disruption, effects of acid on exposed intestinal mucosa, and the presence of staples or suture material. Factors that increase the risk of marginal ulcers include smoking and nonsteroidal anti-inflammatory drug use, whereas proton pump inhibitor use appears to decrease the risk. The true incidence of a marginal ulcer after an RYGB is uncertain, with reports that range from <1% to 36%.[28-30]

GERD

Obesity itself is a risk factor for GERD, and symptomatic GERD is frequent in the bariatric population, with a prevalence of 30% to 60%.[31-34] The effects of bariatric interventions on GERD appear to be variable. Both gastric banding and RYGB were shown, in multiple series, to reduce GERD symptoms at rates that approach or exceed 90%.[31,35-37] However, other studies suggest the converse, with increased symptoms after surgery[38,39] and endoscopic evidence of reflux esophagitis in up to 56% of patients.[40] Postoperative GERD may be related to gastrojejunal anastomotic stenosis. In addition, patients who have postoperative symptoms may have underlying motility disorders; one study suggests that gastric bands may aggravate symptoms of GERD in this population.[32] The variable results may also represent differences in the size of the gastric pouch or band position. It is suggested that the size of the pouch and quantity of acid secretion influence the incidence and severity of GERD symptoms.

Symptoms of GERD after surgery should be managed as in patients who did not have a bypass.[14] An endoscopy should be reserved for the evaluation of symptoms refractory to medical therapy or to rule out complications of GERD and inciting factors, such as obstruction of the gastrojejunal anastomosis, increased pouch size, or distal limb obstruction. Nonacid regurgitation in patients with a band might indicate an inappropriately tight band adjustment, and these patients should be referred to their surgeon for additional evaluation.

Fistula

Gastric leaks and gastrogastric fistulas are potentially serious complications of gastric bypass surgery and occur in 1% to 6% of patients.[35,41-44] Extraluminal gastric leaks can result in cutaneous fistula, peritonitis, abscess, sepsis, organ failure, and death.[45] Clinical manifestations include tachycardia; fever; nausea; vomiting; and flank, abdominal, or chest pain. Most leaks occur at the gastrojejunal anastomosis, with nearly all the rest occurring in the remnant (excluded) stomach; leaks from the jejunojejunal anastomosis are less common but do occur and usually require reoperation. Early postoperative extraluminal leaks are usually diagnosed by upper-GI contrast studies or CT, although the false-negative rate was reported at 30%.[46] There is little role for an endoscopy in the presence of known leaks or fistulas in the early postoperative period. An endoscopy can be considered if the patient is clinically stable, there is uncertainty of the diagnosis, or if there is a planned endoscopic intervention.[47,48]

Chronic gastrogastric fistulas may be found in the presence of marginal ulcers, and patients may present with nausea, vomiting, epigastric pain, and weight gain. An upper-GI contrast study is sensitive for their detection. A large fistula can also be visualized by an endoscopy. Endoscopic therapy for postoperative fistulas has been performed by using fibrin-glue injection[49,50] or self-expanding stents.[51-53] Case reports and small case series indicate that fistula closure may also be achieved by using various combinations of mucosal ablation, glue, the application of endoscopic clips, the placement of self-expanding stents, and endoscopic suturing devices.[54-56] However, these interventions cannot be routinely recommended at this time, because of a lack of controlled data.

Stenosis

Gastrojejunal stomas are generally between 10 and 12 mm in diameter to maximize the restrictive nature of the operation. Anastomotic strictures, defined as anastomoses that are smaller than 10 mm in diameter, are a common complication of RYGB that occur in 3% to 28% of patients.[57-60] The occurrence of gastrojejunal strictures may be associated with marginal ulcers. Patients with anastomotic strictures generally present with nausea, vomiting, or dysphagia, usually within the first year after surgery.[57] Stenosis can be identified by contrast radiography, but direct endoscopic visualization is preferable, because it has high sensitivity.[61] In addition, marginal ulceration can be identified, and dilation of strictures can be performed.

Endoscopic dilation of anastomotic strictures can be performed safely and effectively by using through-the-scope balloon dilators and wire-guided bougie dilators.[59,62,63] If the stenosis cannot be traversed by an endoscopy, then fluoroscopy is useful to allow guidewire passage. Gradual dilation over multiple sessions may reduce the risk of perforation.[57,64] Even with multiple sessions, some stenoses cannot be adequately dilated by endoscopic means, and reoperation is needed.[57] It is controversial if dilation to a diameter larger than 15 to

16 mm should be performed, because it could possibly lead to weight regain. However, in one study, dilation to at least 15 mm was not associated with weight regain, yet, it was associated with a reduced need for more procedures.[65]

It is important to recognize that, in patients with an RYGB, the Roux limb can be delivered to the upper abdomen to connect with the gastric pouch in an antecolic fashion, in front of the transverse colon, or through a retrocolic tunnel created in the transverse mesocolon. If this tunnel is created too tightly or if postoperative stricturing occurs, then this limb can be narrowed and lead to obstructive symptoms.[66] On endoscopic examination, the gastrojejunal anastomosis will be normal, but the jejunum beyond the anastomosis will be dilated until the point where it traverses the mesentery where the stricture will be seen. Because the risk of perforation is high, dilation in these cases is not advised.[67] A review of the operative note and communication with the operating surgeon are helpful in knowing which type of limb delivery was used.

Dumping syndrome

Dumping syndrome is related to rapid emptying from the stomach into the small bowel and does not occur after VBG, LAGB, or DS/BPD. Symptoms may occur early (within 15-20 minutes) or be delayed (up to 2 hours) after a meal and include tachycardia, palpitations, diaphoresis, flushing, diarrhea, nausea, and vomiting. The mechanism is believed to be related to rapid fluid shifts, release of vasoactive peptides, and fluctuations in serum glucose. The true incidence in patients who have had bariatric surgery is unknown but has been reported to be 14% in a meta-analysis of 62 studies.[68] Individual studies reported rates as high as 70%.[69] The diagnosis of dumping syndrome is made based upon clinical presentation, but an endoscopy may be considered to rule out other causes of associated symptoms.[70]

Bezoars

Food bezoars can occur in patients who had weight-loss surgery, most commonly after gastric banding.[71,72] They may form within the first month after surgery or be seen later, with symptoms of nausea, vomiting, and dysphagia.[62] Bezoars can be diagnosed and treated by an endoscopy with fragmentation and removal.[73] Associated gastrojejunal anastomotic stenoses, if present, should be managed with dilation.

Band slippage and erosion

Band erosion into the gastric lumen and band slippage can occur after an LAGB. In a long-term study, a 9.5% rate of band erosion and a 6.3% rate of pouch dilatation/band slippage were seen. In another study, band erosion was identified in 11% of 75 patients with symptoms.[74] Band erosions are best diagnosed at an endoscopy, whereas band slippage may best be diagnosed by contrast radiography. Band erosion may be asymptomatic or can produce abdominal pain, nausea, vomiting, abdominal access-port–site infection, increased food intake or weight gain, and GI bleeding. Band slippage may present with weight gain, increasing reflux symptoms, or obstruction. Endoscopic findings of band slippage may include an enlarged pouch size and reflux esophagitis, gastritis, or ulcers. In severe cases, band slippage can lead to gastric necrosis, a potentially life-threatening condition.[75,76] In patients with VBG, endoscopic removal of the polypropylene mesh that had eroded into the stomach was reported.[77,78]

Bleeding and anemia

Bleeding in the patient after bariatric surgery may be acute or chronic, and may present as iron deficiency anemia.[79] Bleeding may arise anywhere in the upper-GI tract, including the bypassed (excluded) portion of the stomach in patients who had an RYGB. In the early postoperative period, bleeding occurred from the anastomotic staple lines in approximately 1% to 4% of patients who underwent an RYGB.[80] Bleeding is rare in patients who undergo LAGB, with reported incidences as low as 0.1%.[81,82] Patients with signs or symptoms of acute or chronic bleeding should be evaluated with an endoscopy. Accessing the excluded portion of the stomach and the ''Roux'' limb can be difficult and frequently requires the use of a colonoscope or a double-balloon enteroscope.[83] Recently, Shapelock technology (USGI Medical, Inc, San Clemente, Calif) was used to access and evaluate the defunctionalized stomach.[84] When traditional approaches to an endoscopy in the patient with bleeding or anemia are unsuccessful, access may be gained through a surgically created gastrotomy.[85]

Iron deficiency is also a common feature after an RYGB, with an estimated prevalence of 30% to 50%.[86,87] It has also been described with varying prevalence in patients who have undergone DS/BPD.[88,89] The mechanism of iron deficiency is multifactorial. If GI bleeding is suspected, then an appropriate workup should include endoscopic evaluation.

Diarrhea and nutritional deficiencies

Some bariatric procedures are designed to cause intestinal malabsorption. A full description of the nutritional issues in these patients is beyond the scope of this guideline. An endoscopic evaluation for symptoms of diarrhea or nutritional deficiencies should only be pursued if there is a suspicion of small-bowel mucosal disease as a cause for diarrhea.

In patients with diarrhea, evaluation should follow algorithms similar to those advocated for the evaluation of patients without a history of bariatric surgery. The role of endoscopy in the evaluation of diarrhea was reviewed in a separate guideline.[90] Bacterial overgrowth can also occur because of a blind loop syndrome in the excluded small bowel. An empiric trial of antibiotics can be useful in

patients with clinical features consistent with bacterial overgrowth and is a reasonable initial approach. In patients who do not respond to antibiotics, breath testing for bacterial overgrowth or endoscopic aspiration for quantitative bacterial culture from the excluded segment should be considered. Obstruction of the excluded segment can be ruled out with an endoscopy.

Choledocholithiasis and ERCP after bypass

Morbid obesity is a risk factor for gallstone formation, and rapid weight loss is an independent and potentially compounding risk factor. Patients who had bariatric surgery have a high rate of preoperative cholelithiasis and postoperative gallstone formation. Preoperative and intraoperative studies indicated incidences of cholelithiasis of 27% in band candidates[91] and 14% in patients with a gastric bypass, respectively.[92] Postoperative rates of gallstone detection may be as high as 22% to 71%, and cholecystectomy was required in 7% to 41% of patients who underwent gastric bypass.[93,94] Rates of choledocholithiasis after a gastric bypass are unknown. Whereas an ERCP usually can be performed after gastric banding, an ERCP in a patient with an RYGB presents significant technical challenges. No large series of ERCP has been published in this population, and success rates of duodenal intubation are likely dependent on operator skill and surgical factors, such as jejunal limb and afferent loop length. Both side-viewing endoscopes and forward-viewing endoscopes have been used successfully. In the largest reported series composed of 15 patients, the papilla was reached and successfully cannulated in 66% of patients.[95] Needle-knife sphincterotomy, sphincter of Oddi manometry, stone extraction, and biliary stent placement were successfully performed.[95] In cases that are not accessible by standard endoscopy, laparoscopically assisted transgastric ERCP was reported.[96,97] In another series, percutaneous gastroenterostomy tubes were placed into the gastric remnant, and a pediatric duodenoscope was advanced into the gastric remnant.[98] Alternative means of diagnosis (eg, MRCP) and therapy (eg, percutaneous transhepatic intervention) should be considered when treating patients with an RYGB with choledocholithiasis. Because of the exceedingly high incidence of cholelithiasis and symptomatic gallbladder disease after biliopancreatic diversion and a distal (extremely long) RYGB, many surgeons perform prophylactic cholecystectomy at the time of the initial surgery.[99] Although the role of prophylactic cholecystectomy in patients without symptoms and who are undergoing standard RYGB and LAGB remains controversial, prophylactic administration of ursodiol in these patient populations appears to reduce the incidence of gallstone formation.[100,101]

Weight regain

Failing to lose weight or regaining weight after an initial weight loss may indicate the development of a gastrogastric fistula from staple-line dehiscence, a large patulous gastrojejunal anastomosis that fails to restrict food intake, or dilatation of the gastric pouch. While these may be diagnosed by contrast radiography, confirmation of the diagnosis or visualization by an endoscopy may be desirable. Furthermore, some small gastrogastric fistula can be managed endoscopically.[49-55] Excessively patulous gastrojejunal anastomoses were treated successfully with 4-quadrant endoscopic injection of sodium morrhuate into the stoma to cause scarring.[102] By using this method, a stomal size of $\leq$12 mm was achieved in 18 of 28 patients (64%). Emerging technologies may allow endoscopic revision of the gastrojejunal anastomosis and reduction of the pouch size in patients with weight regain after an RYGB.[103]

Endoscopic treatments for obesity

Endoscopic therapy for morbid obesity is desirable. Currently, the endoscopic devices used for the treatment of obesity are space occupying. The first device used in the United States was the Garren-Edwards gastric bubble (American-Edwards Laboratories, Irvine, Calif), a 220-mL polyurethane cylindrical device with a self-sealing valve. A double-blind crossover sham study demonstrated no benefit over diet and behavioral modifications.[104] Complications included gastric erosions, ulcers, small-bowel obstruction, Mallory-Weiss tears, and esophageal lacerations.[105] There may be a role for such devices in patients who are massively obese before consideration of bariatric surgery. One study found that preoperative placement of the Garren-Edwards gastric bubble induced a 10% mean weight loss over 3 months.[106] Another study reported that preoperative placement significantly reduced liver volume, possibly facilitating an RYGB.[107] Other endoscopic treatments are currently under investigation.[105,108]

SUMMARY AND RECOMMENDATIONS

Bariatric surgical intervention presents new challenges to the endoscopist:

- An upper endoscopy should be performed in all patients with upper-GI–tract symptoms who are to undergo bariatric surgery. (Level 2C)
- Upper endoscopy should be considered in all patients who are to undergo an RYGB, regardless of the presence of symptoms. (Level 3)
- In patients without symptoms and who are not undergoing an endoscopy, noninvasive *H pylori* testing followed by treatment, if positive, is recommended. (Level 3)
- In patients without symptoms and who were undergoing gastric banding, a preoperative upper endoscopy should be considered to exclude large hernias that may change the surgical approach. (Level 2C)

- An endoscopic evaluation is useful for diagnosis and management of postoperative bariatric surgical symptoms and complications. (Level 2C)
- An ERCP is difficult in patients who had an RYGB, and an MRCP should be performed in cases where other noninvasive imaging studies are inconclusive. An ERCP in RYGB patients should be selectively performed. (Level 3)

Abbreviations: ASGE, American Society for Gastrointestinal Endoscopy; BMI, Body mass index; DS/BPD, duodenal switch and biliopancreatic diversion; LAGB, laparoscopic adjustable gastric banding; RYGB, Roux-en-Y gastrojejunal bypass; VBG, vertical banded gastroplasty.

REFERENCES

1. Overweight and obesity. Available at: http://www.cdc.gov/nccdphp/dnpa/obesity/defining.htm. Accessed February 18, 2008.
2. Kuczmarski RJ, Carroll MD, Flegal KM, et al. Varying body mass index cutoff points to describe overweight prevalence among U.S. adults: NHANES III (1988 to 1994). Obes Res 1997;5:542-8.
3. Ogden CL, Carroll MD, Curtin LR, et al. Prevalence of overweight and obesity in the United States, 1999-2004. JAMA 2006;295:1549-55.
4. Allison DB, Fontaine KR, Manson JE, et al. Annual deaths attributable to obesity in the United States. JAMA 1999;282:1530-8.
5. Must A, Spadano J, Coakley EH, et al. The disease burden associated with overweight and obesity. JAMA 1999;282:1523-9.
6. McGee DLDiverse Populations Collaboration. Body mass index and mortality: a meta-analysis based on person-level data from twenty-six observational studies. Ann Epidemiol 2005;15:87-97.
7. Calle EE, Thun MJ, Petrelli JM, et al. Body-mass index and mortality in a prospective cohort of U.S. adults. N Engl J Med 1999;341:1097-105.
8. Bray GA. The missing link: lose weight, live longer. N Engl J Med 2007;357:818-20.
9. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults-the evidence report. National Institutes of Health. Obes Res 1998;6:51S-209S.
10. Santry HP, Gillen DL, Lauderdale DS. Trends in bariatric surgical procedures. JAMA 2005;294:1909-17.
11. Griffen WO Jr, Bivins BA, Bell RM. The decline and fall of the jejunoileal bypass. Surg Gynecol Obstet 1983;157:301-8.
12. Buchwald H, Williams SE. Bariatric surgery worldwide 2003. Obes Surg 2004;14:1157-64.
13. Ikenberry SO, Harrison ME, Lichtenstein D, et al. American Society for Gastrointestinal Endoscopy. The role of endoscopy in dyspepsia. Gastrointest Endosc 2007;66:1071-5.
14. Lichtenstein DR, Cash BD, Davilla R, et al. American Society for Gastrointestinal Endoscopy. Role of endoscopy in the management of GERD. Gastrointest Endosc 2007;66:219-24.
15. Hampel H, Abraham NS, El-Serag HB. Meta-analysis: obesity and the risk for gastroesophageal reflux disease and its complications. Ann Intern Med 2005;143:199-211.
16. Greenstein RJ, Nissan A, Jaffin B. Esophageal anatomy and function in laparoscopic gastric restrictive bariatric surgery: implications for patient selection. Obes Surg 1998;8:199-206.
17. Dolan K, Finch R, Fielding G. Laparoscopic gastric banding and crural repair in the obese patient with a hiatal hernia. Obes Surg 2003;13:772-5.
18. Korenkov M, Sauerland S, Shah S, et al. Is routine preoperative upper endoscopy in gastric banding patients really necessary? Obes Surg 2006;16:45-7.
19. Zeni TM, Frantzides CT, Mahr C, et al. Value of preoperative upper endoscopy in patients undergoing laparoscopic gastric bypass. Obes Surg 2006;16:142-6.
20. Verset D, Houben JJ, Gay F, et al. The place of upper gastrointestinal tract endoscopy before and after vertical banded gastroplasty for morbid obesity. Dig Dis Sci 1997;42:2333-7.
21. Sharaf RN, Weinshel EH, Bini EJ, et al. Endoscopy plays an important preoperative role in bariatric surgery. Obes Surg 2004;14:1367-72.
22. Schirmer B, Erenoglu C, Miller A. Flexible endoscopy in the management of patients undergoing RYGB. Obes Surg 2002;12:634-8.
23. Sauerland S, Angrisani L, Belachew M, et al. European Association for Endoscopic Surgery. Obesity surgery: evidence-based guidelines of the European Association for Endoscopic Surgery (EAES). Surg Endosc 2005;19:200-21.
24. Frigg A, Peterli R, Zynamon A, et al. Radiologic and endoscopic evaluation for laparoscopic adjustable gastric banding: preoperative and follow-up. Obes Surg 2001;11:594-9.
25. Azagury D, Dumonceau JM, Morel P, et al. Preoperative work-up in asymptomatic patients undergoing RYGB: is endoscopy mandatory? Obes Surg 2006;16:1304-11.
26. Feitoza AB, Baron TH. Endoscopy and ERCP in the setting of previous upper GI tract surgery. Part I: postsurgical anatomy without alteration of the pancreaticobiliary tree. Gastrointest Endosc 2001;54:743-9.
27. Lattuada E, Zappa MA, Mozzi E, et al. Band erosion following gastric banding: how to treat it. Obes Surg 2007;17:329-33.
28. Wilson JA, Romagnuolo J, Byrne TK, et al. Predictors of endoscopic findings after Roux-en-Y gastric bypass. Am J Gastroenterol 2006;101:2194-9.
29. Sapala JA, Wood MH, Sapala MA, et al. Marginal ulcer after gastric bypass: a prospective 3-year study of 173 patients. Obes Surg 1998;8:505-16.
30. MacLean LD, Rhode BM, Nohr C, et al. Stomal ulcer after gastric bypass. J Am Coll Surg 1997;185:1-7.
31. Nelson LG, Gonzalez R, Haines K, et al. Amelioration of gastroesophageal reflux symptoms following RYGB for clinically significant obesity. Am Surg 2005;71:950-3.
32. Klaus A, Gruber I, Wetscher G, et al. Prevalent esophageal body motility disorders underlie aggravation of GERD symptoms in morbidly obese patients following adjustable gastric banding. Arch Surg 2006;141:247-51.
33. Foster A, Richards WO, McDowell J, et al. Gastrointestinal symptoms are more intense in morbidly obese patients. Surg Endosc 2003;17:1766-8.
34. Di Francesco V, Baggio E, Mastromauro M, et al. Obesity and gastroesophageal acid reflux: physiopathological mechanisms and role of gastric bariatric surgery. Obes Surg 2004;14:1095-102.
35. Perry Y, Courcoulas AP, Fernando HC, et al. Laparoscopic RYGB for recalcitrant gastroesophageal reflux disease in morbidly obese patients. JSLS 2004;8:19-23.
36. Raftopoulos I, Awais O, Courcoulas AP, et al. Laparoscopic gastric bypass after antireflux surgery for the treatment of gastroesophageal reflux in morbidly obese patients: initial experience. Obes Surg 2004;14:1373-80.
37. Nguyen NT, Varela JE, Sabio A, et al. Reduction in prescription medication costs after laparoscopic gastric bypass. Am Surg 2006;72:853-6.
38. Suter M, Dorta G, Giusti V, et al. Gastric banding interferes with esophageal motility and gastroesophageal reflux. Arch Surg 2005;140:639-43.
39. Cobey F, Oelschlager B. Complete regression of Barrett's esophagus after RYGB. Obes Surg 2005;15:710-2.
40. Westling A, Bjurling K, Öhrvall M, et al. Silicone-adjustable gastric banding: disappointing results. Obes Surg 1998;8:467-74.
41. Filho AJ, Kondo W, Nassif LS, et al. Gastrogastric fistula: a possible complication of RYGB. JSLS 2006;10:326-31.
42. Carrodeguas L, Szomstein S, Soto F, et al. Management of gastrogastric fistulas after divided RYGB surgery for morbid obesity: analysis of 1,292 consecutive patients and review of literature. Surg Obes Relat Dis 2005;1:467-74.

43. Gould JC, Garren MJ, Starling JR. Lessons learned from the first 100 cases in a new minimally invasive bariatric surgery program. Obes Surg 2004;14:618-25.
44. Gumbs AA, Duffy AJ, Bell RL. Management of gastrogastric fistula after laparoscopic RYGB. Surg Obes Relat Dis 2006;2:117-21.
45. Carucci LR, Turner MA, Conklin RC, et al. RYGB surgery for morbid obesity: evaluation of postoperative extraluminal leaks with upper gastrointestinal series. Radiology 2006;238:119-27.
46. Gonzalez R, Sarr MG, Smith CD, et al. Diagnosis and contemporary management of anastomotic leaks after gastric bypass for obesity. J Am Coll Surg 2007;204:47-55.
47. Merrifield BF, Lautz D, Thompson CC. Endoscopic repair of gastric leaks after Roux-en-Y gastric bypass: a less invasive approach. Gastrointest Endosc 2006;63:710-4.
48. Eisendrath P, Cremer M, Himpens J, et al. Endotherapy including temporary stenting of fistulas of the upper gastrointestinal tract after laparoscopic bariatric surgery. Endoscopy 2007;39:625-30.
49. Garcia-Caballero M, Carbajo M, Martinez-Moreno JM, et al. Drain erosion and gastro-jejunal fistula after one-anastomosis gastric bypass: endoscopic occlusion by fibrin sealant. Obes Surg 2005;15:719-22.
50. Papavramidis ST, Eleftheriadis EE, Papavramidis TS, et al. Endoscopic management of gastrocutaneous fistula after bariatric surgery by using a fibrin sealant. Gastrointest Endosc 2004;59:296-300.
51. Kriwanek S, Ott N, Ali-Abdullah S, et al. Treatment of gastro-jejunal leakage and fistulization after gastric bypass with coated self-expanding stents. Obes Surg 2006;16:1669-74.
52. Salinas A, Baptista A, Santiago E, et al. Self-expandable metal stents to treat gastric leaks. Surg Obes Relat Dis 2006;2:570-2.
53. Fukumoto R, Orlina J, McGinty J, et al. Use of Polyflex stents in treatment of acute esophageal and gastric leaks after bariatric surgery. Surg Obes Relat Dis 2007;3:68-71.
54. Roberts KE, Duffy AJ, Bell RL. Laparoscopic transgastric repair of a gastrogastric fistula after gastric bypass: a novel technique. Surg Innov 2007;14:18-23.
55. Merrifield BF, Lautz D, Thompson CC. Endoscopic repair of gastric leaks after RYGB: a less invasive approach. Gastrointest Endosc 2006;63:710-4.
56. Torres-Villalobos G, Leslie D, Kellogg T, et al. A new approach for treatment of gastro-gastric fistula after gastric bypass. Obes Surg 2007;17:242-6.
57. Schwartz ML, Drew RL, Chazin-Caldie M. Factors determining conversion from laparoscopic to open Roux-en-Y gastric bypass. Obes Surg 2004;14:1193-7.
58. Sanyal AJ, Sugerman HJ, Kellum JM, et al. Stomal complications of gastric bypass: incidence and outcome of therapy. Am J Gastroenterol 1992;87:1165-9.
59. Carrodeguas L, Szomstein S, Zundel N, et al. Gastrojejunal anastomotic strictures following laparoscopic Roux-en-Y gastric bypass surgery: analysis of 1291 patients. Surg Obes Relat Dis 2006;2:92-7.
60. Podnos YD, Jimenez JC, Wilson SE, et al. Complications after laparoscopic gastric bypass: a review of 3464 cases. Arch Surg 2003;138: 957-61.
61. Messmer JM, Wolper JC, Sugerman HJ. Stomal disruption in gastric partition in morbid obesity (comparison of radiographic and endoscopic diagnosis). Am J Gastroenterol 1984;79:603-5.
62. Escalona A, Devaud N, Boza C, et al. Gastrojejunal anastomotic stricture after Roux-en-Y gastric bypass: ambulatory management with the Savary-Gilliard dilator. Surg Endosc 2007;21:765-8.
63. Peifer KJ, Shiels AJ, Azar R, et al. Successful endoscopic management of gastrojejunal anastomotic strictures after Roux-en-Y gastric bypass. Gastrointest Endosc 2007;66:248-52.
64. Go MR, Muscarella P 2nd, Needleman BJ, et al. Endoscopic management of stomal stenosis after Roux-en-Y gastric bypass. Surg Endosc 2004;18:56-9.
65. Peifer KJ, Shiels AJ, Azar R, et al. Successful endoscopic management of gastrojejunal anastomotic strictures after Roux-en-Y gastric bypass. Gastrointest Endosc 2007;66:248-52.
66. Hwang RF, Swartz DE, Felix EL. Causes of small bowel obstruction after laparoscopic gastric bypass. Surg Endosc 2004;18:1631-5.
67. Wetter A. Role of endoscopy after Roux-en-Y gastric bypass surgery. Gastrointest Endosc 2007;66:253-5.
68. Monteforte MJ, Turkelson CM. Bariatric surgery for morbid obesity. Obes Surg 2000;10:391-401.
69. Pories WJ, Caro JF, Flickinger EG, et al. The control of diabetes mellitus (NIDDM) in the morbidly obese with the Greenville Gastric Bypass. Ann Surg 1987;206:316-23.
70. Ahn LB, Huang CS, Forse RA, et al. Crohn's disease after gastric bypass surgery for morbid obesity: is there an association? Inflamm Bowel Dis 2005;11:622-4.
71. Parameswaran R, Ferrando J, Sigurdsson A. Gastric bezoar complicating laparoscopic adjustable gastric banding with band slippage. Obes Surg 2006;16:1683-4.
72. Veronelli A, Ranieri R, Laneri M, et al. Gastric bezoars after adjustable gastric banding. Obes Surg 2004;14:796-7.
73. Pinto D, Carrodeguas L, Soto F, et al. Gastric bezoar after laparoscopic Roux-en-Y gastric bypass. Obes Surg 2006;16:365-8.
74. Frigg A, Peterli R, Zynamon A, et al. Radiologic and endoscopic evaluation for laparoscopic adjustable gastric banding: preoperative and follow-up. Obes Surg 2001;11:594-9.
75. Iannelli A, Facchiano E, Sejor E, et al. Gastric necrosis: a rare complication of gastric banding. Obes Surg 2005;15:1211-4.
76. Foletto M, De Marchi F, Bernante P, et al. Late gastric pouch necrosis after Lap-Band, treated by an individualized conservative approach. Obes Surg 2005;15:1487-90.
77. Evans JA, Williams NN, Chan EP, et al. Endoscopic removal of eroded bands in vertical banded gastroplasty: a novel use of endoscopic scissors (with video). Gastrointest Endosc 2006;64:801-4.
78. Adam LA, Silva RG Jr, Rizk M, et al. Endoscopic argon plasma coagulation of Marlex mesh erosion after vertical-banded gastroplasty. Gastrointest Endosc 2007;65:337-40.
79. Buchwald H, Avidor Y, Braunwald E, et al. Bariatric surgery: a systematic review and meta-analysis. JAMA 2004;292:1724-37.
80. Nguyen NT, Longoria M, Chalifoux S, et al. Gastrointestinal hemorrhage after laparoscopic gastric bypass. Obes Surg 2004;14: 1308-12.
81. Rao AD, Ramalingam G. Exsanguinating hemorrhage following gastric erosion after laparoscopic adjustable gastric banding. Obes Surg 2006;16:1675-8.
82. Biertho L, Steffen R, Ricklin T, et al. Laparoscopic gastric bypass versus laparoscopic adjustable gastric banding: a comparative study of 1,200 cases. J Am Coll Surg 2003;197:536-44, discussion 544-5.
83. Sakai P, Kuga R, Safatle-Ribeiro AV, et al. Is it feasible to reach the bypassed stomach after Roux-en-Y gastric bypass for morbid obesity? The use of the double-balloon enteroscope. Endoscopy 2005;37:566-9.
84. Pai RD, Carr-Locke DL, Thompson CC. Endoscopic evaluation of the defunctionalized stomach by using ShapeLock technology (with video). Gastrointest Endosc 2007;66:578-81.
85. Sundbom M, Nyman R, Hedenström H, et al. Investigation of the excluded stomach after Roux-en-Y gastric bypass. Obes Surg 2001; 11:25-7.
86. Halverson JD. Micronutrient deficiencies after gastric bypass for morbid obesity. Am Surg 1986;52:594-8.
87. Amaral JF, Thompson WR, Caldwell MD, et al. Prospective hematologic evaluation of gastric exclusion surgery for morbid obesity. Ann Surg 1985;201:186-93.
88. Skroubis G, Sakellaropoulos G, Pouggouras K, et al. Comparison of nutritional deficiencies after Roux-en-Y gastric bypass and after biliopancreatic diversion with Roux-en-Y gastric bypass. Obes Surg 2002; 12:551-8.
89. Dolan K, Hatzifotis M, Newbury L, et al. A clinical and nutritional comparison of biliopancreatic diversion with and without duodenal switch. Ann Surg 2004;240:51-6.
90. Eisen GM, Dominitz JA, Faigel DO, et al. Use of endoscopy in diarrheal illnesses. Gastrointest Endosc 2001;54:821-3.

91. Kiewiet RM, Durian MF, van Leersum M, et al. Gallstone formation after weight loss following gastric banding in morbidly obese Dutch patients. Obes Surg 2006;16:592-6.
92. Villegas L, Schneider B, Provost D, et al. Is routine cholecystectomy required during laparoscopic gastric bypass? Obes Surg 2004;14: 60-6.
93. Wudel LJ Jr, Wright JK, Debelak JP, et al. Prevention of gallstone formation in morbidly obese patients undergoing rapid weight loss: results of a randomized controlled pilot study. J Surg Res 2002;102:50-6.
94. Puzziferri N, Austrheim-Smith IT, Wolfe BM, et al. Three-year follow-up of a prospective randomized trial comparing laparoscopic versus open gastric bypass. Ann Surg 2006;243:181-8.
95. Wright BE, Cass OW, Freeman ML. ERCP in patients with long-limb Roux-en-Y gastrojejunostomy and intact papilla. Gastrointest Endosc 2002;56:225-32.
96. Ceppa FA, Gagne DJ, Papasavas PK, et al. Laparoscopic transgastric endoscopy after RYGB. Surg Obes Relat Dis 2007;3:21-4.
97. Martinez J, Guerrero L, Byers P, et al. Endoscopic retrograde cholangiopancreatography and gastroduodenoscopy after RYGB. Surg Endosc 2006;20:1548-50.
98. Martinez J, Guerrero L, Byers P, et al. Endoscopic retrograde cholangiopancreatography and gastroduodenoscopy after RYGB. Surg Endosc 2006;20:1548-50.
99. Mason EE, Renquist KE. Gallbladder management in obesity surgery. Obes Surg 2002;12:222-9.
100. Sugerman HJ, Brewer WH, Shiffman ML, et al. A multicenter, placebo-controlled, randomized, double-blind, prospective trial of prophylactic ursodiol for the prevention of gallstone formation following gastric-bypass-induced rapid weight loss. Am J Surg 1995;169:91-6, discussion 96-7.
101. Miller K, Hell E, Lang B, et al. Gallstone formation prophylaxis after gastric restrictive procedures for weight loss: a randomized double-blind placebo-controlled trial. Ann Surg 2003;238: 697-702.
102. Catalano MF, Rudic G, Anderson AJ, et al. Weight gain following bariatric surgery as a result of a large gastric stoma: endotherapy with sodium morrhuate may prevent the need for surgical revision. Gastrointest Endosc 2007;66:240-5.
103. Thompson CC, Slattery J, Bundga ME, et al. Peroral endoscopic reduction of dilated gastrojejunal anastomosis after Roux-en-Y gastric bypass: a possible new option for patients with weight regain. Surg Endosc 2006;20:1744-8.
104. Meshkinpour H, Hsu D, Farivar S. Effect of gastric bubble as a weight reduction device: a controlled, crossover study. Gastroenterology 1988;95:589-92.
105. Gostout CJ, Rajan E. Endoscopic treatments for obesity: past, present and future. Gastroenterol Clin North Am 2005;34:143-50.
106. Alfalah H, Philippe B, Ghazal F, et al. Intragastric balloon for preoperative weight reduction in candidates for laparoscopic gastric bypass with massive obesity. Obes Surg 2006;16:147-50.
107. Frutos MD, Morales MD, Luján J, et al. Intragastric balloon reduces liver volume in super-obese patients, facilitating subsequent laparoscopic gastric bypass. Obes Surg 2007;17:150-4.
108. Schauer P, Chand B, Brethauer S. New applications for endoscopy: the emerging field of endoluminal and transgastric bariatric surgery. Surg Endosc 2007;21:347-56.

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