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## Role of endoscopy in the bariatric surgery of patients

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### Abstract

Obesity is an increasingly serious health problem in nearly all Western countries. It represents an important risk factor for several gastrointestinal diseases, such as gastroesophageal reflux disease, erosive esophagitis, hiatal hernia, Barrett's esophagus, esophageal adenocarcinoma, *Helicobacter pylori* infection, colorectal polyps and cancer, non-alcoholic fatty liver disease, cirrhosis, and hepatocellular carcinoma. Surgery is the most effective treatment to date, resulting in sustainable and significant weight loss, along with the resolution of metabolic comorbidities in up to 80% of cases. Many of these conditions can be clinically relevant and have a significant impact on patients undergoing bariatric surgery. There is evidence that the chosen procedure might be changed if specific pathological upper gastrointestinal findings, such as large hiatal hernia or Barrett's esophagus, are detected preoperatively. The value of a routine endoscopy before bariatric surgery in asymptomatic patients (screening esophagogastroduodenoscopy) remains controversial. The common indications for endoscopy in the postoperative bariatric patient

include the evaluation of symptoms, the management of complications, and the evaluation of weight loss failure. It is of critical importance for the endoscopist to be familiar with the postoperative anatomy and to work in close collaboration with bariatric surgery colleagues in order to maximize the outcome and safety of endoscopy in this setting. The purpose of this article is to review the role of the endoscopist in a multidisciplinary obesity center as it pertains to the preoperative and postoperative management of bariatric surgery patients.

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**Key words:** Morbid obesity; Obesity surgery; Endoscopy; Complications; Endoscopic therapy

**Core tip:** Gastrointestinal endoscopists play an integral role in the multidisciplinary treatment of obese patients undergoing bariatric surgery, particularly in the treatment of postoperative complications. Endoscopy is emerging as an effective procedure in the treatment of bariatric surgery complications in selected patients, while avoiding invasive surgical reoperation.

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### INTRODUCTION

Obesity is an increasingly serious health problem in nearly all Western countries. Estimates of prevalence suggest that 7%-15% of subjects in developed countries are obese<sup>[1-8]</sup>.

Obesity is usually defined in terms of body mass index (BMI, kg/m<sup>2</sup>). The World Health Organization, the National Institutes of Health, Healthy People 2010, and the 2000 Dietary Guidelines for Americans, proposed

guidelines for the classification of weight status based on the BMI<sup>[9-11]</sup>. Accordingly, a BMI of 25-30 is considered overweight, a BMI of 30 to 35 is considered class 1 obesity, 35-40 as class 2, and over 40 as class 3. Morbid obesity is usually defined as a BMI of over 40 or a BMI over 35 in combination with comorbidities. Underweight is usually defined as a BMI of less than 18.5 kg/m<sup>2</sup>.

Obesity is an independent risk factor for a variety of chronic diseases such as diabetes, hypertension, coronary heart disease, knee osteoarthritis, and cancer<sup>[12-18]</sup>. A recent study on the association between different grades of obesity and the number of life-years lost indicated that life expectancy can be up to 20 years shorter in severe obesity<sup>[19]</sup>.

Intentional weight loss offers substantial benefits to patients and is associated with an overall reduction in mortality<sup>[20]</sup>. Current treatment modalities for obesity include lifestyle modification, diet, and pharmacologic agents; however, their effectiveness and durability is limited<sup>[21]</sup>. Surgery is the most effective treatment to date, resulting in sustainable and significant weight loss along with the resolution of metabolic comorbidities in up to 80% of cases<sup>[22-24]</sup>.

The next frontier in the treatment of obesity might be represented by the development of endoscopic approaches to bariatric procedures<sup>[25-31]</sup>. Endoluminal surgery, performed entirely by using flexible endoscopes, offers the potential for less invasive approaches that may be safer and more cost-effective compared with current laparoscopic approaches, thus extending surgical indications to those with multiple comorbidities, older age, and those with mild obesity (BMI: 30-35).

The purpose of this article is to review the role of the endoscopist in the preoperative and postoperative management of bariatric surgery patients, in the context of a multidisciplinary obesity center.

## PRE-OPERATIVE ENDOSCOPY

Obesity is an important risk factor for several digestive diseases, such as gastroesophageal reflux disease, erosive esophagitis, hiatal hernia (HH), Barrett's esophagus, esophageal adenocarcinoma, *Helicobacter pylori* infection, colorectal polyps and cancer, non-alcoholic fatty liver disease (NAFLD), cirrhosis, and hepatocellular carcinoma. Most of these diseases are observed up to 2-3 times more frequently in obese patients than in normal weight individuals<sup>[32]</sup>.

Many of these conditions can be clinically relevant and have a significant impact on patients undergoing bariatric surgery. There is evidence that the chosen procedure might be changed if specific pathological upper GI findings, such as a large HH or Barrett's esophagus, are detected preoperatively.

The published guidelines of the European Association for Endoscopic Surgery state that esophagogastroduodenoscopy (EGDS), or upper-GI series, is advisable for all bariatric procedures and strongly recommended

for gastric bypass patients [Roux-en-Y gastric bypass (RYGB)]. Similarly, the recently published guidelines from the ASGE recommended that EGDS should be performed in all symptomatic patients undergoing bariatric surgery, and considered in all candidates<sup>[33,34]</sup>. Symptomatic patients should undergo EGDS (diagnostic) in accordance with accepted practice guidelines, regardless of whether they are being considered for bariatric surgery or not.

The value of a routine endoscopy before bariatric surgery in asymptomatic patients (screening EGDS) remains controversial<sup>[35]</sup>. A lack of correlation between patient symptoms and endoscopic findings has been documented by many authors, suggesting that routine preoperative endoscopy might be useful in detecting both lesions and inflammation<sup>[36-40]</sup>. However, considering the relatively weak clinical relevance of the majority of lesions discovered on routine EGDS and the cost and invasiveness of the procedure, as well as the amount of secondary unnecessary workup prompted by irrelevant findings, several authors have instead advocated a non-endoscopic approach for asymptomatic patients<sup>[41,42]</sup>.

One of the concerns of performing routine preoperative upper endoscopy is the risk of sedation. Cardio-pulmonary complications are the most serious adverse reactions associated with conscious sedation at the time of EGDS, with a mortality rate of 0.03% and a serious morbidity rate of 0.54%<sup>[43]</sup>. In cases of morbidly obese patients, the risk may be higher due to the higher incidence of restrictive lung disease, obstructive sleep apnea, pulmonary hypertension, and cardiac diseases. It is of paramount importance that endoscopy procedures in obese patients are carried out in a fully equipped setting and by a well-organized team of anesthetists trained in the use of anesthetic drugs and in the treatment of adverse events.

## POST-OPERATIVE ENDOSCOPIC MANAGEMENT

Several surgical procedures are currently performed to induce weight loss in obese patients. These procedures have been simplified into three categories: predominantly restrictive procedures, predominantly malabsorptive procedures, and combined procedures (Table 1).

The common indications for endoscopy in postoperative bariatric patients include the evaluation of symptoms, the management of complications, and the evaluation of weight loss failure.

Of critical importance is for the endoscopist to be familiar with the postoperative anatomy and work in close collaboration with bariatric surgery colleagues to maximize outcomes and the safety of endoscopy in this setting<sup>[44]</sup>.

Although nausea, vomiting, and abdominal pain are commonly encountered symptoms after bariatric surgery and may result from dietary non-compliance, patients with persistent symptoms should be evaluated, as these

**Table 1 Common bariatric surgery procedures**

Predominantly restrictive	Predominantly malabsorptive	Mixed
Vertical banded gastroplasty	Biliopancreatic diversion	Gastric bypass surgery
Adjustable gastric band		Sleeve gastrectomy with duodenal switch
Sleeve gastrectomy		
Gastric plication		

**Table 2 Upper gastrointestinal post-bariatric surgical complications**

Intervention	Complications
Banded gastroplasty	Band erosion
Adjustable gastric banding	Band erosion
	Overinflated band
Roux-en-Y gastric bypass	Gastrointestinal bleeding
	Marginal ulceration
	Anastomotic leak and fistula
	Gastrojejunal stricture
Biliary-pancreatic diversion and duodenal switch	Anastomotic leak, fistula and stricture

symptoms may indicate the development of a complication, especially within the first 6 postoperative months.

Each procedure is associated with specific GI complications (Table 2).

Gastrointestinal complications prompting endoscopy after surgery may be summarized as follow: acute bleeding and/or anemia, staple-line complications (such as anastomotic leaks, fistulae, and strictures), band stenosis, erosion and slippage, bezoars, and choledocholithiasis.

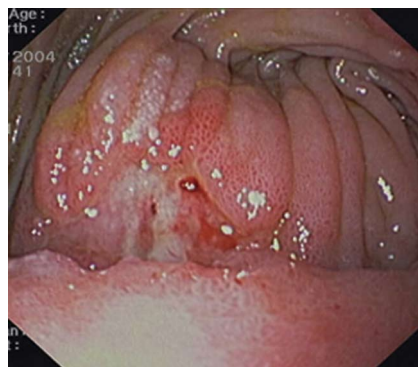
An endoscopy is the preferred strategy, unless there is a suspicion of leaks or fistulae, in which case preliminary contrast radiography may be more appropriate.

### Role of endoscopy to diagnose and treat hemorrhage

Early upper hemorrhage (within 48 h) are mostly reported after laparoscopic RYGB surgery (1%-4%)<sup>[45-49]</sup>. The bleeding lesions are often identified at the staple lines of the gastrojejunostomy and rarely at the jejunojejunostomy, gastric pouch, or bypassed stomach. Although there are few published case series, endoscopic management of hemorrhage from the gastrojejunal anastomosis has been shown to be highly successful when using standard hemostatic modalities<sup>[50-53]</sup>. Late hemorrhage may often arise from marginal ulcers or erosion (Figures 1 and 2), and generally requires medical therapy (PPIs) or, in cases of acute bleeding, endoscopic treatment. Balloon enteroscopy has been reported in patients with GI bleeding arising from the bypassed stomach, but should be undertaken only with great caution<sup>[54-56]</sup>.

### Role of endoscopy in treating staple-line complications

Endoscopic treatment plays an important role in the management of a variety of staple-line complications,



**Figure 1** Patient with late hemorrhage after Roux-en-Y gastric bypass: endoscopic view shows a marginal ulceration with a visible vessel at the base of the lesion.



**Figure 2** Multiple erosions in the anastomosed jejunum.

such as stomal stenosis and anastomotic leaks.

**Stricture of the gastrojejunal anastomosis:** Stricture of the gastrojejunal anastomosis resulting in dysphagia, vomiting, and nutritional deficiencies, is a relatively common late complication of both open and laparoscopic RYGBP, occurring in approximately 3% to 12% of patients after RYGB<sup>[57-61]</sup>.

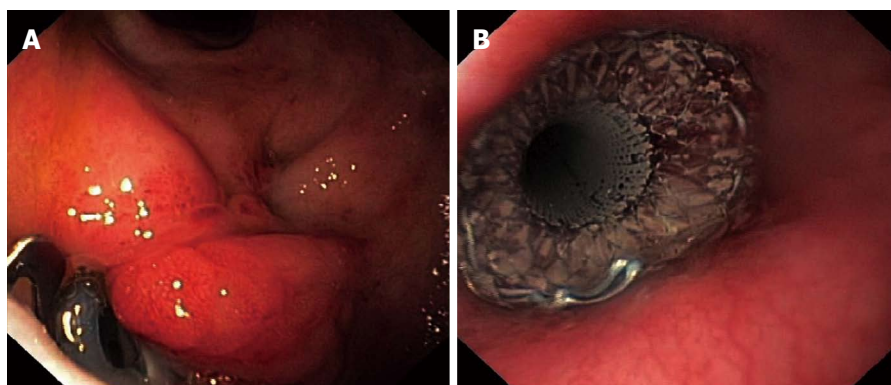
There is no formal definition of stricture size, but generally an anastomosis with a diameter < 10 mm or the inability to allow passage of a standard upper endoscope (diameter 8.6-9.8 mm) is considered a significant stricture.

Endoscopic dilation of stomal stenosis *via* through the scope balloon dilation or wire-guided bougie dilation is safe and highly effective, and should be considered the primary treatment for this complication<sup>[62-67]</sup>. The majority of patients can be successfully treated with 1 or 2 sessions, and surgical revision is rarely necessary<sup>[62]</sup>.

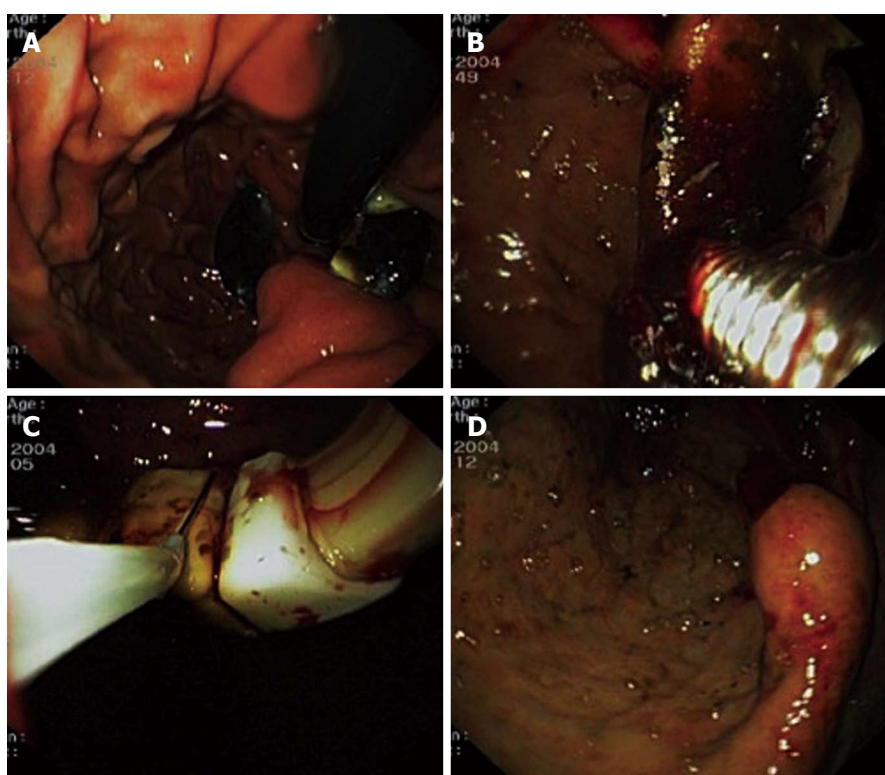
A potential risk of stricture dilation is inadvertent over-dilatation, leading to weight regain. Overall, it appears that stricture dilation to a maximum of 15 mm is not associated with impaired postoperative weight loss outcomes<sup>[62,68]</sup>.

**Staple-line dehiscence, or leak formation:** Staple-line dehiscence, or leak formation can lead to abdominal pain, thoracic pain nausea, vomiting, intra-abdominal abscess,





**Figure 3 Patient with fistula after sleeve gastrectomy.** A: Endoscopic view of fistula at the upper portion of staple line in a patient after laparoscopic sleeve gastrectomy; a clip is visible on the boundary of the fistulous orifice as a result of a unsuccessful previous attempt at treatment; B: Fully covered removable stent (Taewoong Niti-S™ esophageal Mega stent) was implanted, promoting healing of the fistula.



**Figure 4 Different steps of endoscopic Lap-Band extraction.** A: Endoscopic view of an almost penetrated band, with only a small tissue bridge holding the device to the gastric wall; B: Endoscopic view of the AMI gastric band cutter (CJ Medical, Haddenham, United Kingdom) passed around the band after endoscopic resection of the tissue bridge; C: After the section, the band is grasped at the connection with the port-site, and extracted through the mouth; D: Gastric pouch outlet aspect after ring extraction (retrovision from the stomach).

and acute peritonitis.

Leak rates vary by type of surgical intervention, with large series reporting 2.05% to 5.20% for laparoscopic RYGB, and 1.68% to 2.60% for open RYGB. Sleeve gastrectomy has an associated leak rate of 0.6% to 7%<sup>[49,58,59,69-73]</sup>.

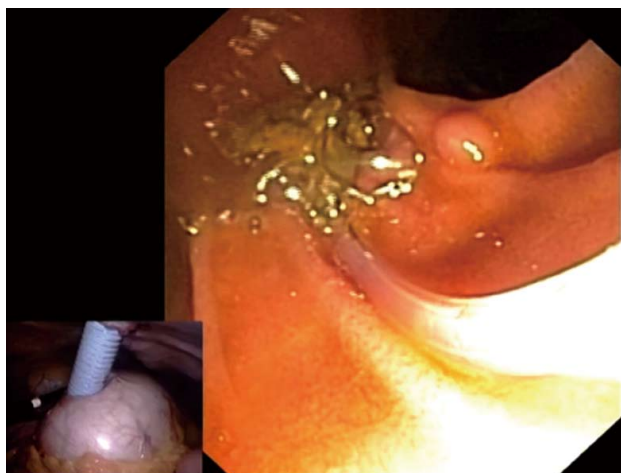
The most common sites for RYGB leaks are at the gastrojejunal anastomosis, followed by the jejunojejunosomy anastomosis; in sleeve gastrectomy, leaks usually occur at the proximal border within 2 cm of the angle of His.

The first step is the treatment of sepsis and supportive care, including total parenteral nutrition and trans-

cutaneous drainage catheter placement. Some leaks may resolve with these conservative steps. For stable patients in whom conservative management has failed, laparoscopic repair should be considered. Additionally, in these patients, endoscopy is emerging as an effective procedure in the treatment of anastomotic leakage, while avoiding invasive surgical reoperation.

Chronic leaks have been successfully repaired endoscopically by using fibrin-glue injection<sup>[74-76]</sup>, clip placement<sup>[77]</sup>, self-expanding stents<sup>[78-82]</sup>, and endoscopic suturing devices<sup>[83]</sup> (Figure 3).

Although endoscopic therapy for gastric leak manage-



**Figure 5** Laparoscopic assisted endoscopic retrograde cholangiopancreatography after Roux-en-Y gastric bypass. A side-viewing endoscope is inserted through a 15-mm trocar that was previously placed into the excluded stomach. Subsequently, endoscopic retrograde cholangiopancreatography is performed in the usual fashion.

ment holds promise, these procedures cannot be routinely recommended, due to the lack of controlled data.

#### **Role of endoscopy to diagnose and treat laparoscopic adjustable gastric banding complications**

The laparoscopic adjustable gastric band (LAGB) is well-established as a safe, effective, and durable bariatric procedure<sup>[84-86]</sup>.

Several complications are related to LAGB, including reflux esophagitis, stenosis with esophageal dilation, band slippage, and erosion.

LAGB erosions typically occur 1-2 years after placement. The prevalence varies in published studies from 0.9% to 3.8%<sup>[86-88]</sup>. Gastric band erosion may occur with abdominal pain, nausea, vomiting, abdominal access port-site infection, increased food intake, or weight gain, and is easily identified with endoscopy. The traditional approach is surgical revision; however, there are reports of conservative management with endoscopic removal on complete intragastric erosion<sup>[89-92]</sup> (Figure 4).

#### **Role of endoscopy to treat choledocholithiasis in patients with gastric by-pass**

Morbid obesity is a risk factor for gallstone formation, and rapid weight loss is an independent and potentially compounding risk factor<sup>[93-95]</sup>.

Whereas an endoscopic retrograde cholangiopancreatography (ERCP) can usually be performed after gastric banding or sleeve gastrectomy, an ERCP in a patient with an RYGB presents significant technical challenges.

Several options are available to gain access to the biliary tree in patients after RYGB. Laparoscopic creation of a point of access to the gastric remnant or small bowel allows the duodenoscope to reach the papilla, but carries the inherent risks of general anesthesia and surgery<sup>[96-100]</sup> (Figure 5). Enteroscopes, colonoscopes, and more recent double-balloon and single-balloon endoscopes have also

been used. However, duct cannulation is difficult with the forward-viewing enteroscope, and precut biliary sphincterotomy is often required. Furthermore, accessories are limited due to the length of the enteroscope<sup>[101-107]</sup>.

## **CONCLUSION**

GI endoscopists play an integral role in the multidisciplinary treatment of obese patients undergoing bariatric surgery, particularly in the treatment of postoperative complications. Direct communication and coordination with the surgical team is critical in the preoperative and immediate postoperative setting. Endoscopy is emerging as an effective procedure in the treatment of bariatric surgery complications in selected patients, while avoiding invasive surgical reoperation.

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