

Revisional Bariatric Surgery



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KEYWORDS

- Revisional surgery • Failed gastric band • Failed gastric bypass
- Failed sleeve gastrectomy • Conversion • Weight recidivism

KEY POINTS

- Revisional bariatric procedures are becoming increasingly common. Inevitably 5–8% of primary bariatric procedures will fail requiring a revisional operation.
- The main reasons for revisional bariatric surgery are either primary inadequate weight loss, weight recidivism, or inherit specific complications related to the procedure itself.
- The most successful conversion strategy relies on selecting the most appropriate revisional procedure, including one-stage versus two-staged and laparoscopic versus open, and involving a multidisciplinary team approach to the patient.
- The gold standard revisional option is usually to laparoscopically convert a restrictive operation to a Roux-en-Y gastric bypass in order to have the best balance of long term weight loss, resolution of complications related to the primary procedure and acceptable rate of perioperative complications.

ADJUSTABLE GASTRIC BAND/LAPAROSCOPIC ADJUSTABLE GASTRIC BANDING

History

Initially introduced in the early 1990s, adjustable gastric banding (AGB) is the most commonly performed bariatric operation in many places in the world, including Europe, Australia, and South America, and is the second most commonly performed bariatric procedure in the United States.^{1–5} Largely based on its acceptable weight loss, technical simplicity, low morbidity profile, and reversibility, more than 300,000 laparoscopic adjustable gastric banding (LAGB) procedures have been performed

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worldwide since US Food and Drug Administration approval in 2001.³ However, as is common in primarily restrictive bariatric operations, the failure rate is quite high. Failure rates have been reported ranging between 40% and 50%, with 20% to 30% of patients requiring a revisional operation.³

Brief description of the surgical procedure

Using minimally invasive techniques for gaining entry, a gastric band is placed just below the gastroesophageal junction and fixed with 3 or 4 nonabsorbable sutures on the anterior aspect.⁶ The approximate size of the gastric pouch should be between 50 and 80 mL.⁷

Indications for Revision

Although primary inadequate weight loss and secondary weight regain are common indications for revision after banding, other complications, including hardware malfunctions with the band, tubing, or access port; esophageal motility issues; and psychological intolerance to the band, are common causes that lead to revision (**Table 1**).⁸

Inadequate weight loss and secondary weight recidivism

There are many considerations, often overlapping, when evaluating a patient for either inadequate weight loss or weight regain. These considerations include technical factors from suboptimal band adjustments, adverse gastrointestinal symptoms such as reflux, and maladaptive eating behaviors. It is important to evaluate all these factors in a multidisciplinary bariatric care clinic before considering revisional surgery of any kind.⁴

Hardware problems

Band slippage is a common postoperative issue following LAGB. With an incidence ranging between 1% and 22%, it is the primary reason for reoperation in 2% to 69% of revisional cases.^{7,9,10} It is defined as either the downward migration of the band with the anterior wall of the stomach migrating through the band (anterior slip) or the herniation of the posterior wall of the stomach through the band (posterior slip).⁷

Table 1

Indications for revision following adjustable gastric band/laparoscopic adjustable gastric banding

Issues	Incidence (%)
Insufficient weight loss	13.7–62.5
Weight recidivism	33.3–40
Hardware problems	
Slippage	2–76
Band erosion	0–11
Band intolerance	0.6–6.2
Early band obstruction	0.5–11
Port and tubing problems	4.3–24
Motility problems	
Esophageal dilation	37.5
Gastric pouch dilation	0.4–40
Miscellaneous	
GERD	33
Band intolerance	0.6–6.2

Data from Refs.^{4–14}

Band erosion is seen when the band gradually erodes into the gastric lumen. It has a prevalence of 3% to 11%.⁷ It may result from stomach wall injury during the initial surgery but more commonly results from chronic pressure imposed by the band.

Band intolerance, defined as symptoms such as vomiting, esophageal spasm, and gastrointestinal reflux disease (GERD) in the absence of clinical obstruction, has an incidence of 0.6% to 6.2%.¹¹

Port and tubing problems, as a composite complication, have an incidence of 4% to 24% and consist of band erosion or displacement and tubing leakage, breakage, or disconnection.¹¹

Motility problems

Pouch enlargement is defined as dilation of the proximal gastric pouch without overt evidence of a band slip. Radiologically, there may or may not be a change in the angle of the band.⁷ It is usually a consequence of chronic outlet obstruction imposed by the band, leading to proximal dilatation. Some evidence suggests it may also be related to overeating.⁷

Conversion Strategies

Key principles

1. *Appropriate revisional operation selection.* Choosing the most appropriate revisional surgery following failed LAGB depends largely on the indications for revision themselves. If the primary cause was inadequate weight loss, reflux, or band erosion/intolerance/obstruction, then conversion to a malabsorptive procedure such as Roux-en-Y gastric bypass (RYGB) or duodenal switch (DS) is most appropriate.³ Several investigators advocate the key principle in conversion surgery is that a failed restrictive bariatric surgery due to poor weight loss should include a revisional option with a malabsorptive component. Others suggest that if the gastric band failed due to either band slippage or pouch dilatation, yet independent of weight outcomes, then potential revisional options include rebanding or conversion to a laparoscopic sleeve gastrectomy (LSG).³ Decision-making should include the presence of symptoms related to GERD, because this should sway patients and surgeons away from another restrictive operation. Educating patients with regards to all possible options as well as their risks and benefits is of paramount importance because studies have shown that 96% of patients felt that they were unaware of all their bariatric surgical options before agreeing to an operation.¹⁵
2. *One-staged versus 2-staged revisional operations.* Traditional opinion was that a 2-step operation, consisting of band removal and then at a later date a conversion operation, would allow chronic inflammatory changes induced by the gastric band to settle and would therefore reduce gastric staple line leak and anastomotic stricture rates.^{16,17} However, opponents of this strategy would argue that the disadvantage of 2-step operations is the potential for weight regain in the waiting period, in addition to the risks of undergoing an additional general anesthetic.¹⁸ The literature remains divided in this recommendation. An interesting study by Tan and colleagues¹⁹ revealed that inflammatory changes following band removal might be irreversible; therefore, the speculation might be that leak rates, regardless of timing, would be higher compared with a primary operation.
3. *Open versus laparoscopic.* Laparoscopic bariatric surgery is associated with fewer postoperative complications and decreased hospital length of stay, and therefore, should be considered the standard of treatment.^{20,21}

Adjustable gastric band/laparoscopic adjustable gastric banding removal

Although there have been scattered reports of maintaining the band during conversions to LSG or RYGB, band removal is the standard of care when performing a revisional operation.^{3,14} Band removal, without a subsequent conversion to another bariatric operation, will often solve many the adverse gastrointestinal symptoms; however, weight regain or inadequate weight loss will not be addressed.³

Common indications for band removal alone include acute slippage with necrosis or perforation, erosion, intractable nausea and vomiting, intractable dysphagia, band infection, and patient desire.^{9,11}

It is important to note that conservative management consisting of band volume adjustment is indicated for initial, first-line treatment of minimal anterior slippage and esophageal dilation.⁹

Adjustable gastric band/laparoscopic adjustable gastric banding replacement/refixation

Rebanding for failed gastric bands is a heavily debated topic. Successful laparoscopic refixation and rebanding have been reported in the literature, with a reduction in band slippage rates and improved excess weight loss (EWL).^{6,10} In comparing rebanding with repositioning, rebanding was associated with a nonsignificant reduction in the rate of future operations (5.3% vs 22.6%).¹³ Most investigators would argue that for failed weight loss, the gastric band should be converted to a malabsorptive procedure; however, for hardware failures such as band slippage or band defect such as a punctured balloon, there is a role for laparoscopic band replacement or re-fixation.⁶

Adjustable gastric band/laparoscopic adjustable gastric banding to Roux-en-Y gastric bypass

Revision from the LAGB to laparoscopic Roux-en-Y gastric bypass (LRYGB) is generally considered the gold standard.²² Conversion to RYGB is associated with excellent long-term weight loss outcomes, with a quoted decrease in body mass index (BMI) of approximately 10 kg/m² at 1-, 2-, and 4-year follow-ups.³ Quoted %EWL based on prebanding weight ranges between 50% and 57%.^{4,23,24} The main indications for conversion to an RYGB include inadequate weight loss, weight recidivism, reflux, and esophageal dysmotility.^{8,13} Conversion to RYGB is associated with longer operative times and higher complication rates compared with primary RYGB.⁴ Literature-cited complication rates following revisional RYGB range between 3% and 29.3%, with an overall complication rate of 8.5%. Anastomotic leak and bleeding rates were reported at a combined rate of approximately 3%.²⁵

Adjustable gastric band/laparoscopic adjustable gastric banding to laparoscopic sleeve gastrectomy

A recent review of conversion of the LAGB to LSG reported a drop in BMI at 1 and 2 years of approximately 8.8 kg/m² and 10.8 kg/m², respectively. Quoted %EWL based on prebanding weight was roughly 40%.^{26,27} However, there was significant weight regain greater than 2 years after LSG of approximately 8 kg/m².³ As well, increased overall complication rates following LSG were reported by Coblijn and colleagues²⁵ in a recent systematic review (LSG 12.2% vs RYGB 8.5%). Specifically, the quoted incidence of anastomotic leak rates following LSG was 5.6%.²⁵

The advantages of the LSG over the RYGB are the technical ease of the operation, reduced mean hospital stay, and decreased operating room (OR) time.²⁵ However, the LSG lacks a malabsorptive component and involves the transection of the band's fibrous capsule, which could potentially lead to tissue ischemia and therefore might explain the observed higher postoperative leak rates.¹² The fibrous capsule must be

removed in order to increase the chances of creating a uniformly tubular stomach with conversion to LSG.

Reflux disease leading to AGB failure should be a contraindication for conversion to an LSG.¹¹

Adjustable gastric band/laparoscopic adjustable gastric banding to biliopancreatic diversion with duodenal switch

Successful conversion to the BPD-DS leads to considerable %EWL compared with RYGB, but has marked perioperative morbidities.²² Topart and colleagues²² reported 73% EWL for their series of 21 patients following DS from their initial weight, but had significantly higher complication rates (62 vs 12.5%) compared with RYGB. Limited evidence exists, only small case series or case reports, in the literature as to the efficacy and safety of the DS in revisional surgery from the LAGB.^{22,28}

LEGACY PROCEDURE

The Nonadjustable Gastric Band

History

The nonadjustable gastric band (NAGB) was first performed in the late 1970s by Wilkinson and Peloso.²⁹ Based on the concept of restricting oral intake by reducing gastric volume, an implanted band material was placed around the upper part of the stomach in a process called gastric segmentation. The band material itself was variable, including polypropylene mesh, Dacron graft, silastic tubing, and Gore-Tex mesh.²⁹⁻³¹

Indications for revision

Although long-term weight-loss outcomes were underwhelming, long-term complications after NAGB were significant. Band slippage, band erosion, and esophagitis were all morbid and common complications.^{31,32} Naslund and colleagues³³ published one of the longest follow-up studies following NAGB in the literature, consisting of 80 patients. They found that during their almost 10-year follow-up, not only was weight regain very common, but also only 31% of patients actually had an intact band in follow-up investigations. Their conclusion was quite bold, stating that they could not recommend the NAGB as a general treatment for morbid obesity.³³

Nonadjustable gastric band to Roux-en-Y gastric bypass The literature is sparse about revisional operations after the NAGB, but the limited case series point to the efficacy of conversion to RYGB.^{31,34}

Conversion to RYGB is heavily favored over LSG, because the site of band erosion or stricturing can be avoided.³⁴ Because of the desmoplastic reaction caused by the NAGB, a fibrous and thickened stomach wall results. Therefore, the gastric pouch must be created proximal to the site of the capsule.³¹ Band removal can be performed laparoscopically, with care taken to remove as much of the fibrous capsule as possible. Should the band erode, it can be removed either endoscopically, laparoscopically, or combined laparoendoscopically.³⁴

Vertical Banded Gastroplasty

History

Vertical banded gastroplasty (VBG) was first described by Mason³⁵ in 1982 and quickly became the most commonly performed primary bariatric surgery in the late 1980s. Although reported short-term weight loss outcomes, roughly 50% EWL, and low perioperative morbidity rates made this procedure promising initially, high long-term failure rates in the range of 20% to 65% made the VBG less appealing.^{11,36} Observed reoperative rates

after VBG are between 10% and 56%.¹¹ VBG is associated with the highest operation failure rates compared with any other primary bariatric surgery option.³⁷

Brief description of the surgical procedure As originally described by Mason and colleagues, the operator places a 32-French Ewald tube per oral into the stomach, flush to the lesser curvature. Then, a site 8 to 9 cm below the angle of His is selected for the 2.5-cm gastric window to be created with an Anvil stapler. Through this window, a noncutting stapler was then applied in the cephalad direction toward the angle of His along the Ewald tube to create a 50-cc tubularized gastric pouch. This technique was later altered by MacLean and colleagues³⁸ to attempt to reduce the high rates of gastrogastric fistulas by completely dividing the staple line. In addition, the outlet to the pouch was banded with either Marlex mesh, polypropylene, or silastic ring to maintain a constant stomal circumference.^{11,35}

Indications for revision

Inadequate weight loss and weight recidivism are the primary indications, ranging between 5% and 61%, for patients seeking a revisional bariatric surgery.¹¹ However, other common indications are related to proximal gastric outlet obstruction, leading to reflux, food intolerance, band erosion, and staple line disruption (**Table 2**).

Inadequate weight loss and secondary weight recidivism Poor weight outcome patients can be divided into 2 separate groups after VBG: patients with intact anatomy versus patients with abnormal anatomy. Patients with intact VBG anatomy usually fail due to maladaptive eating behaviors. Because of obstructive-like symptoms imposed by the band, patients will exhibit maladaptive eating behaviors by consuming soft or liquid foods, which tend to be calorie dense. Patients with abnormal anatomy due to staple line breakdown or band erosion may be regaining their weight due to lack of a restrictive component. Regardless, a multidisciplinary approach with counseling and nutritional education is essential in addition to the surgical therapy.

Conversion strategies

Key principles

1. *Revisional surgery is complex.* Revisional surgeries are associated with increased morbidity compared with primaries.⁴² Increased adhesions and distorted anatomy

Issues	Incidence (%)
Insufficient weight loss	10–100
Weight recidivism	26–74
Technical reasons	
Wide outlet	14–17.1
Pouch dilation	3–15.8
Staple line erosion	2.7–47.6
Stoma stenosis	9.9–100
Band erosion	6.3–11
Band dehiscence	0.7
Miscellaneous	
GERD	16.6–65

Data from Refs.^{26,27,38–42}

lead to longer OR times and increased rates of bleeding.⁴⁰ Consideration should be given for the placement of a gastrostomy tube during conversion to an RYGB for immediate decompression, and in the event of a leak, for long-term enteral feeding.⁴⁰ Because of technical complexity and potential for morbid perioperative complications, reoperative bariatric surgeries should be performed in tertiary care hospitals by experienced, high-volume bariatric surgeons.¹¹

2. *Anastomotic strictures are common following failed VBG.* The proximal stomach is often chronically inflamed, with the presence of thickened mucosa, which together can lead to stricturing.⁴⁰ Transection of the stomach to create the gastric pouch may also disrupt the vascular supply, therefore further increasing the risk of anastomotic stricture.⁴²

Vertical banded gastroplasty reversal Reversal is an option in patients not desiring conversion to RYGB or are otherwise higher-risk surgical candidates.¹¹ Thoreson and Cullen³⁹ published a series of VBG reversals in 28 patients. A gastrostomy was performed and, using a linear stapler, an intraluminal side-to-side gastrogastrostomy was created. Following surgery, presenting symptoms of gastric outlet obstruction including nausea and vomiting, reflux, and food intolerance improved in 89% of patients, with minor perioperative complications. Patients, on average, gained 8 kg at 32 months follow-up after reversal.³⁹

Vertical banded gastroplasty revision Revision surgery to a re-VBG has been associated with poor surgical outcomes in the literature and is generally not performed. van Gemert and colleagues⁴¹ compared revision re-VBG to conversion to RYGB and found that 68% of re-VBG patients will require another surgery over a 5-year time period compared with 0% of conversion RYGB patients.

In a study by Hunter and colleagues,⁴³ poor long-term outcomes were found in their 69 revision patients, with only 23% of patients having successful revisional surgeries. Stomal dilation and stomal stenosis, in particular, as primary indications for revision were associated with higher failure rates of 55% and 83%, respectively. The investigators concluded that although re-VBG revision surgery, in general, has poor response rates, stomal dilation or stenosis patients, in particular, should be converted to the bypass.⁴³ From a safety point of view, high gastric leak rates have been reported in the re-VBG perioperative period, necessitating eventual conversion to a gastric bypass.^{44,45}

Vertical banded gastroplasty to Roux-en-Y gastric bypass Conversion to RYGB is the gold standard and resolves complications related to proximal gastric outlet obstruction while assisting with weight loss.⁴⁵ Gagne and colleagues,⁴⁰ in their series of 94 patients undergoing conversion for poor weight-loss outcomes, described an EWL of 47% at 26 months following conversion to LRYGB. Complications were divided between early and late, but 38% of patients reported a complication. Notable early complications (<30 days) were anastomotic leaks (4.8%) and marginal ulcers (2.9%), with reoperations (diagnostic laparoscopy) required in 9.5% of patients.⁴⁰ Notable late complications (>30 days) included anastomotic structuring (11.4%), internal herniation (1.9%), and jejunojejunostomy site perforation (1.0%), with reoperation required in 9 patients and endoscopic dilation in 10 patients.

Iannelli and colleagues⁴² performed a smaller case series in 2008 on 18 patients undergoing revision from VBG to RYGB with similar results. They reported no perioperative mortalities and low conversion-to-open rates (5.5%), with similar anastomotic leak (5.5%) and stricture (11.1%) rates to Gagne and colleagues.⁴⁰ The investigators concluded that conversion of failed VBG to RYGB is the “ideal” solution.

Vertical banded gastroplasty to laparoscopic sleeve gastrectomy The specific surgical steps in conversion of VBG to LSG, as described by Iannelli and colleagues,²⁶ varies slightly depending on whether the original VBG was a true Mason or modified MacLean technique. For the MacLean VBG, only the distal stomach is divided, and for the Mason VBG, the stomach is divided medially to the vertical staple line.

Foletto and colleagues²⁷ observed high leak rates in their series of 5 VBG patients converted to an LSG, because 40% of these patients had leaks that were conservatively managed. The explanation behind the observed higher leak rates following conversion to LSG compared with RYGB may be due to proximity of the new staple line to the previous vertical staple line. More likely, though, when the site of the band or mesh is transected, the tissue is most at risk for vascular compromise leading to the high risk for leaks.⁴⁶

Vertical banded gastroplasty to biliopancreatic diversion with duodenal switch The data are limited on the conversion of VBG to DS. Dapri and colleagues⁴⁶ converted a series of 12 patients from VBG to DS. Although the mean EWL was quite impressive at 85.1% at a mean follow-up time of 43 months, the outcomes from this case series were quite poor. Six patients suffered major complications (4 leaks) with 3 patients suffering mortality within 8 months of their surgery.⁴⁶ The average length of stay was 35 days. They concluded that laparoscopic conversion of VBG to DS has an unacceptable rate of complications and death.⁴⁶

Laparoscopic Sleeve Gastrectomy

History

The sleeve gastrectomy was first introduced by Hess and Hess⁴⁷ in 1988 as a component of their newly introduced open hybrid operation, the biliopancreatic diversion with duodenal switch (BPD-DS). As the BPD-DS evolved, it became a laparoscopic operation⁴⁸ and subsequently LSG was performed as a first stage in a 2-staged operation in high-risk and severely obese patients.⁴⁹ After short-term weight loss was shown to be promising from the first-stage LSG, the second stage was increasingly abandoned until LSG became a stand-alone primary bariatric procedure around 2005.⁴⁹

Brief description of the surgical procedure The lesser sac is entered via ligation of the gastroepiploic vessels along the greater curvature of the stomach using an energy device.⁴⁹ Dissection then proceeds in the cephalad direction to the left pillar of the hiatus.⁴⁹ A linear cutting stapler is then introduced along with a per-oral 32 to 40 French bougie. The stapler then fires along the length of the bougie, approximately 6 cm proximal to the pyloric valve, until the greater curvature of the stomach is completely transected.^{49,50} The stomach is transformed into a “banana-shaped” gastric pouch of approximately 20% of the original stomach volume and total capacity of 100 to 150 mL.^{5,49}

Indications for revision

Not surprisingly, inadequate weight loss and weight recidivism are the primary indications for patients seeking a revisional bariatric surgery.⁵¹ However, other indications include development of GERD, staple-line stricture, pouch dilatation, and anastomotic leak (**Box 1**).

Inadequate weight loss/weight regain Although LSG is associated with good long-term weight loss, with 48% to 53% EWL, approximately 5% to 10% of patients will have poor weight loss outcomes and require a revisional procedure.^{51,52}

Technical reasons Sleeve strictures leading to obstruction most commonly occur at the angularis incisura, as a result either of technical factors or from creation of an inappropriately small luminal diameter.¹¹ First-line treatment is usually endoscopic

Box 1**Indications for revision following laparoscopic sleeve gastrectomy***Issues*

Insufficient weight loss

Weight recidivism

Technical reasons

Anastomotic leaks

Sleeve stricture

Sleeve dilation

Miscellaneous

GERD

Data from Brethauer SA, Kothari S, Sudan R, et al. Systematic review on reoperative bariatric surgery: American Society for Metabolic and Bariatric Surgery Revision Task Force. Surg Obes Relat Dis 2014;10(5):952–72.

dilatation; however, this is usually followed by definitive surgical therapy such as conversion to RYGB.¹¹

Anastomotic leaks are very challenging because they are difficult to control with drainage or stenting. Acute or chronic leaks may lead to fistulous disease. Conversion to RYGB is usually the mainstay of treatment for difficult to control leaks.¹¹

Miscellaneous The effect of LSG on reflux is debateable.^{53,54} However, long-term studies have commented that approximately 1 in 5 patients will develop new GERD following LSG and that preoperative presence of reflux will be maintained following LSG.⁵⁵

Conversion strategies

Key principles

1. *Sleeve dilation or not?* As a distensible organ, the stomach may stretch over time. Patients presenting with weight regain will often be found to have a dilated tubular stomach on upper endoscopy or upper gastrointestinal series. Nonetheless, a re-sleeve is not the standard of care and should not be considered as a long-term viable option for weight control.⁵⁶ Rather, a conversion to a malabsorptive operation is the mainstay of treatment.
2. *BMI ≥ 50 kg/m²?* Although RYGB is the gold-standard conversion procedure, surgeons must consider DS for patients with BMI of 50 kg/m² or greater.^{57,58} DS has been shown to be superior in weight-loss outcomes and comorbidity resolution in the superobese patient.^{57,58}
3. *GERD or not?* Resleeve should not be considered in LSG failures associated with GERD. Instead, patients should be converted to RYGB, which is the ultimate anti-reflux operation, because acid and bile will be diverted away from the esophagus.⁵⁴
4. *Preoperative assessment is crucial.* Assessing whether the patient has significant risk factors for perioperative complications is of utmost importance. Patients with prior thromboembolic disease and nutritional deficiencies would benefit more with conversion to RYGB rather than DS because of a shorter procedural length and decreased long-term nutritional complications.⁵⁶

Resleeve gastrectomy The RLSG involves a refashioning of the dilated gastric pouch.⁵⁹ A recent 2014 systematic review of failed LSG found that there is no

difference in efficacy between the RLSG and RYGB at 24-month follow-up, with both procedures having approximately 45% EWL.⁶⁰ The advantages of the RLSG are that it is not associated with profound nutritional deficiencies; it is associated with less dumping syndrome, and it is technically a simpler operation.⁵⁹

Conversion to a malabsorptive procedure Choosing the appropriate malabsorptive conversion procedure for failed LSG is difficult. Although conversion to RYGB is most widely accepted in the literature and there is a paucity of data on conversion to DS, the LSG was originally described as the first step in a staged BPD-DS 2-step procedure.⁶⁰ At the latest International Consensus summit on Sleeve Gastrectomy, most surgeons converted to the RYGB (46%) followed by DS (24%) for weight regain.⁵⁴ The only systematic review by Cheung and colleagues⁶⁰ on revisional LSG found that after conversion to RYGB, patients had 68% and 44% EWL at 1 year and 2 years or more, respectively. DS was not analyzed individually because of the lack of primary studies available.

Carmeli and colleagues⁵⁶ retrospectively compared BDP-DS and RYGB in 19 patients. At the last follow-up, patients had more significant weight loss following DS versus RYGB, 80.3% versus 66.6% of EWL, respectively.⁵⁶ Importantly, DS also had improved rates of comorbidity resolution, 84% versus 67%. However, DS was associated with more long-term complications, mainly nutritional.⁵⁶

Roux-en-Y Gastric Bypass

History

Developed in 1967 by Mason, RYGB has become the gold standard in primary and revisional bariatric surgery.

Indications for revision

Around 10% to 20% of patients following RYGB, as a primary procedure, will have inadequate weight loss or weight regain at 2 years, with a subset of these individuals requiring a revisional surgery.^{61–63} Other RYGB-specific complications can also be primary indications for revision, including gastric pouch dilatation, gastrogastric fistulas, anastomotic strictures or ulcers, and metabolic derangements (**Box 2**).

Metabolic/endocrine derangements Severe malnutrition, vitamin deficiency, refractory hypoglycemia, and recalcitrant hypocalcemia have all been reported as revisional indications following RYGB.¹¹

Conversion strategies

Reversal of Roux-en-Y gastric bypass Reversal to normal intestinal continuity is only indicated in extreme circumstances of intractable nausea/vomiting, extreme weight loss and malnutrition, metabolic abnormalities, nonhealing ulcerations or leaks, and patient choice.¹¹ Case reports in the literature report successful resolution of endocrine, metabolic, and nutritional abnormalities following reversal, with improved metabolic parameters.^{64,65} Refeeding syndrome is a concern for these patients, especially patients with extremely low BMI.⁶⁵ Fifty percent to 88% of patients will regain weight following reversal.⁶⁴

Banding Roux-en-Y gastric bypass The placement of AGBs/NAGBs on the gastric pouch following failed RYGB is termed “salvage” banding. Indications for banding after RYGB failure include pouch dilation and gastrojejunostomy dilation.⁶³ A recent review of banding following failed RYGB included only 7 studies.^{61,63} Excess BMI loss ranged between 28.3% and 64.9%.⁶³ The less invasive nature of banding when compared with conversion to DS makes it an appealing revisional option.⁶³ However,

Box 2**Indications for revision following Roux-en-Y gastric bypass***Issues*

Insufficient weight loss

Weight recidivism

Extreme weight loss

Technical reasons

Gastrogastric fistula

Gastric pouch dilation/stricture

Gastrojejunostomy dilation/stricture

Marginal ulcers

Bowel loss: internal hernia/small bowel volvulus

Roux stasis syndrome

Dumping syndrome

Miscellaneous

Metabolic/endocrine derangements

Bypass intolerance

Data from Refs. ^{11,62,64}

it is not without its complications, because 18% of patients developed long-term complications, which included band erosion and band slippage, with 17% of patients requiring a re-revision.⁶³

Roux-en-Y gastric bypass limb lengthening The concept of Roux limb lengthening is based on increasing the malabsorption component of the gastric bypass and thereby increasing weight loss. Systematic reviews examining the efficacy of Roux limb length on weight loss found that limb length makes no difference on weight loss outcomes for non-superobese patients, but there might be a small benefit in the patients with BMI of 50 kg/m² or more.^{66,67} Christou and colleagues⁶⁸ found that at 10-year follow-up, the length of the Roux limb (40 cm vs 100 cm) was not associated with differing weight loss outcomes. Therefore, lengthening the Roux limb as a revisional procedure seems to have little utility.

Gastric pouch revisions Revision of the gastric pouch for poor weight loss can be performed in several ways: either complete takedown of the gastrojejunostomy, trimming the gastric pouch, placing a gastric band (as mentioned previously), or endoluminal reduction.^{69,70} Pouch reduction with neo-gastrojejunostomy will address an enlarged pouch and stoma; however, if there is isolated pouch enlargement on the greater curvature side, then reduction of the pouch alone may be an option.⁷¹ Muller and colleagues⁷¹ laparoscopically revised 5 patients for pouch dilatation by a complete reconstruction of the pouch and reported a mean change in BMI of 3.9 kg/m² at 23-month follow-up. Nguyen and colleagues⁷² performed revisional trimming of the pouch with or without redo gastrojejunostomy anastomosis in 44 patients and reported 38% EWL.^{bib72} Endoluminal techniques achieve gastric pouch and stomal reduction via tissue plication. Mild short-term weight loss is reported but long-term weight-loss outcomes are poor because restriction is immediately lost once the plication sutures fail.^{70,73}

Revisional options for marginal ulcer complications involve gastrojejunostomy resection with primary anastomosis with or without a truncal vagotomy. Case reports

and series in the literature have shown the efficacy of this approach for patients with persistently symptomatic marginal ulcers who have failed appropriate medical management.^{74,75}

Roux-en-Y gastric bypass to duodenal switch Perhaps the best indication for conversion to DS in revisional surgery is for failed RYGB.⁷⁶ Parikh and colleagues⁷⁷ converted 12 patients to DS and reported 62.7% EWL equating to a mean BMI reduction of 10.5 kg/m² at 11-month follow-up. Surprisingly, there were no leaks in the series, only 4 strictures that were managed with endoscopic dilation and reoperative revision. Other small case series and case reports have reported the efficacy of conversion for indications including poor weight loss outcomes, hypoproteinemia, and dumping syndrome.^{76,78} A few specific technical considerations must be taken into account by the operator. The preservation or sacrifice of the Roux limb in the restoration of continuity and the preservation of the lesser curve gastric vessels that feed the new gastrogastrostomy and the sleeve gastrectomy should both be given significant consideration during conversion.⁷⁸

SUMMARY

All bariatric surgical procedures, especially restrictive ones, are at risk for failure, from either poor weight loss outcomes or procedural-specific complications. An experienced bariatric surgeon within a multidisciplinary team should make the ultimate determination to convert. The gold standard is to laparoscopically convert a restrictive operation to an RYGB in order to have the best balance of long-term weight loss, resolution of complications related to the primary procedure, and acceptable rate of perioperative complications.

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