Chapter

Revisional Bariatric Surgery

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Abstract

Metabolic surgery is considered a valuable tool in treating obesity compared to the non-surgical approach. Its effectiveness is evident in the form of weight loss, eliminating obesity-related comorbidities, and improving quality of life. Hence, the rate of metabolic surgery conducted worldwide has risen dramatically, parallel to the increasing rates of obesity. Unfortunately, there are drawbacks to metabolic surgeries. Weight regain/insufficient weight loss is feared by the patient and bariatric surgeon and can occur with nonadherence to a healthy lifestyle and dietary habits. Long-term complications related to metabolic surgery are possible following any metabolic surgery (e.g., chronic reflux, malnutrition, and fistula). Revisional surgery is the most effective approach to combat these drawbacks, and therefore a bariatric surgeon should be familiar with it. This chapter will discuss the indication of revisional surgery, the preoperative workup, the surgical techniques, and the outcome of revisional surgery. The chapter will focus on the most commonly performed metabolic surgery, that is, laparoscopic adjustable gastric band, laparoscopic sleeve gastrectomy, laparoscopic Roux-en-Y gastric bypass, and laparoscopic one anastomosis gastric bypass. By the end of this chapter, the reader will be able to: (1) Define metabolic surgery failure and indications of the revision. (2) Be able to approach the patient preoperatively and formulate a plan. (3) Be knowledgeable about the main operative steps. (4) Be aware of the predicted outcome of revisional surgery.

Keywords: revisional surgery, adjustable gastric band, sleeve gastrectomy, Roux-en-Y gastrectomy, one anastomosis gastric bypass, laparoscopy

1. Introduction

Obesity is now considered an epidemic worldwide and rising at an alarming rate. Not only does obesity increase the chance of developing debilitating comorbidities and affects the quality of life, but also has a major load on health systems and increases costs [1]. One of the most effective tools to tackle obesity is bariatric surgery. It showed remarkable and durable results compared to other means, such as lifestyle changes and intensive medical management [2]. Despite its effectiveness, due to the sedentary lifestyle and the availability of calorie-dense foods, in addition to other factors, weight regain or failure to lose is becoming more prevalent. Other issues of surgical intervention, in general, are the possible occurrence of surgery-related specific complications. Hence, revisional surgery is becoming more popular recently to address these inconveniences. This chapter will address the most common revisional bariatric surgeries practiced.

2. Revision of laparoscopic adjustable gastric band

The laparoscopic adjustable gastric band (LAGB) was introduced in the 1970s with a simple weight loss mechanism for restricting food intake [3]. Since its implementation in the surgical practice, LAGB has shown promising results and gained popularity [4–6]. One of its attractiveness is its reversibility and less-invasive nature than other metabolic procedures [7]. Despite these remarks, LAGB has fallen behind other metabolic procedures. In the most recent IFSO data, LAGB is the fourth most common procedure behind the laparoscopic sleeve gastrectomy (LSG), laparoscopic Roux-en-Y gastric bypass (RYGB), and the one anastomosis gastric bypass (OAGB).

2.1 Indication for revision

With the development of other types of metabolic surgery, the efficacy and results sustainability of LAGB was questioned [8–10]. Another reason for the LAGB decline is the nature of the procedure of inserting a foreign body. This can lead to various complications like band intolerance (slippage, reflux, and esophageal dilatation], port/tube complications (bowel obstruction and infection), or even band erosion through the stomach wall [11]. Hence, band removal is probably inevitable due to different indications. These indications for revision vary in the literature (**Table 1**).

2.2 Preoperative workup

Before the operation, interviewing the patient by the managing team is crucial to accomplish the desired goals. Symptoms of band intolerance should be carefully assessed, such as epigastric pain, dysphagia, and regurgitation. Band deflation should be considered preoperatively. All patients should undergo an upper contrast study to evaluate the anatomy, assess for reflux/hiatal hernia, and assess if there is neo-pouch development or any signs of band slippage. Band erosion symptoms can vary significantly from being asymptomatic to port infection. Esophagogastroduodenoscopy (EGD) is a valuable tool that should be used if there is any suspicion of band erosion or significant reflux disease [17]. **Figure 1** provides a suggested pathway for AGB management.

Author	Number of patients	Band intolerance	Reflux	Band failure	Port/tube complications	Erosion
Emous et al. [12]	257	32.2%	NA	64.2%	0.5%	5.4%
Yeung et al. [13]	104	14%	12%	71%	3%	NA
Falk et al. [14]	211	60%	4.9%	20.5%	4.9%	4.3%
Jaber et al. [15]	85	63.5%	NA	22.4%	NA	1.2%
Kirshtein et al. [16]	214	61.6%	NA	9.8%	7%	13.1%

Table 1.
Indications of laparoscopic adjustable gastric band revision in selected studies.

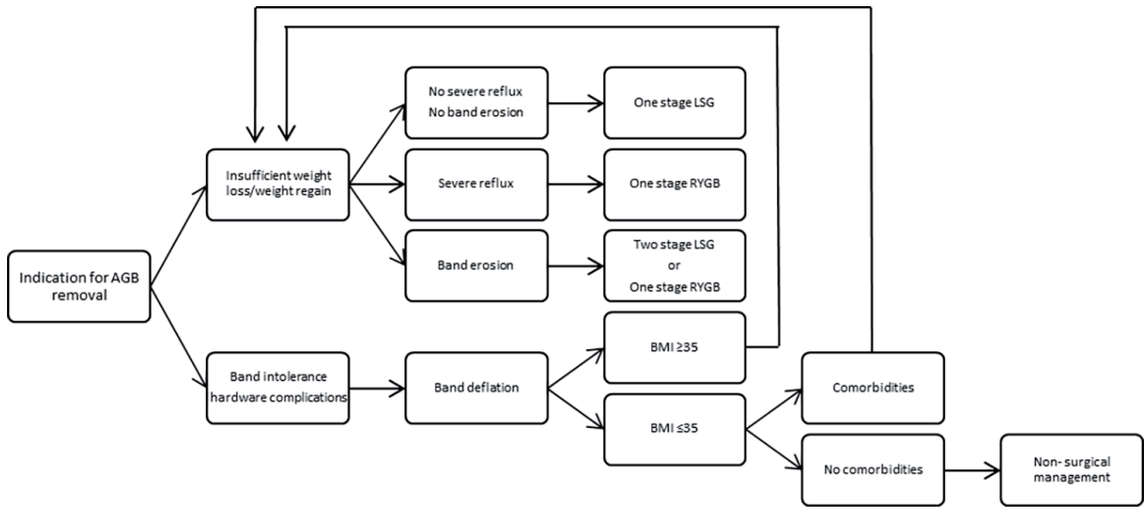

Figure 1.
Suggested pathway decision for adjustable gastric band revision.

2.3 The operation

All patients should receive preoperative antibiotics and prophylaxis for the venous thromboembolic event (VTE). After anesthesia induction, the site of the port should be marked. The abdomen is accessed using a 5 mm visiport at the left upper quadrant 5 cm from the umbilicus. Another 5 mm port in the left upper quadrant is placed at a planned incision site for port removal. A superior epigastric incision is used for Nathanson's retractor to assist with left hepatic lobe retraction. A 12 mm port is placed 5 cm to the right and superior to the umbilicus. Another 5 mm port is placed in the right upper quadrant. The adhesions of the band should be dissected thoroughly, making sure not to injure the stomach. Complete circumferential dissection is needed to remove the band (**Figure 2**). Then the tube can be divided near its insertion into the band. It is advisable to separate any fibrous tissue adherent to the stomach wall to

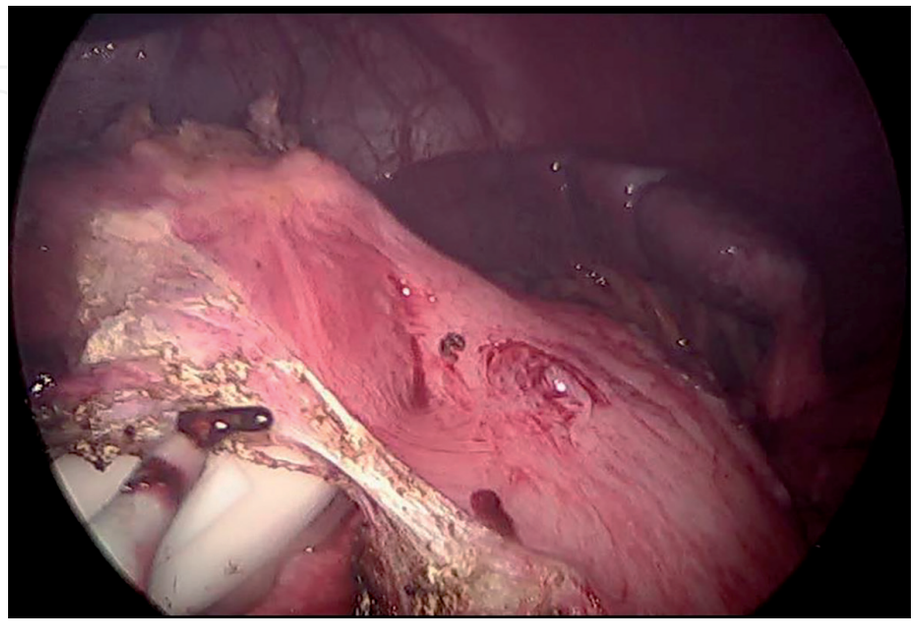

Figure 2.
Circumferential dissection around the band.

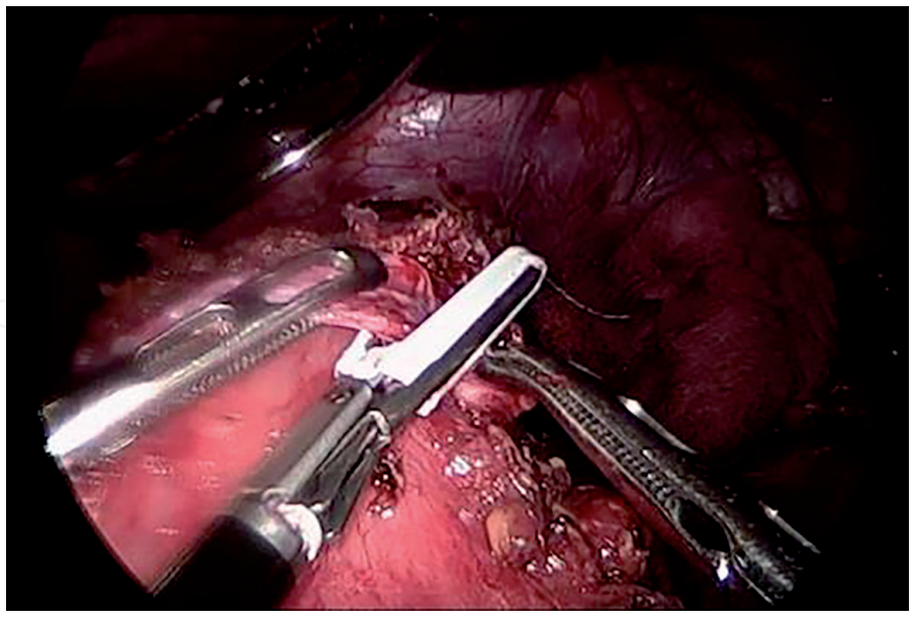

Figure 3.
Resection of fibrous tissue.

apply the stapler safely (**Figures 3** and **4**). Then laparoscopic sleeve gastrectomy is done by dividing the greater omentum to the gastroesophageal junction. It is crucial to assess for hiatal hernia. If present, complete mobilization of 2–3 cm intraabdominal esophagus should be accomplished with a posterior and anterior nonabsorbable suture repair (**Figures 5** and **6**). Creating the sleeve is started by applying staplers along a 36Fr bougie. We prefer to apply clips long the sleeve but not a full deployment to control bleeding. Reinforcement of the staple line with sutures is advisable. The procedure is completed by exteriorizing the band and the resected stomach, removing the port, and closing the skin.

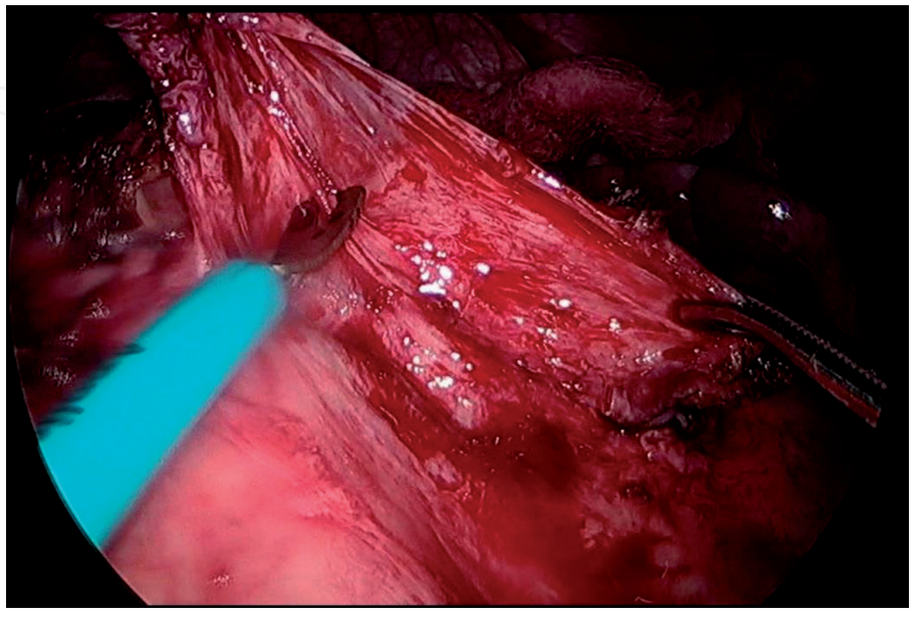

Figure 4.
Fine dissection of reactive tissue caused by the band before applying the stapler.

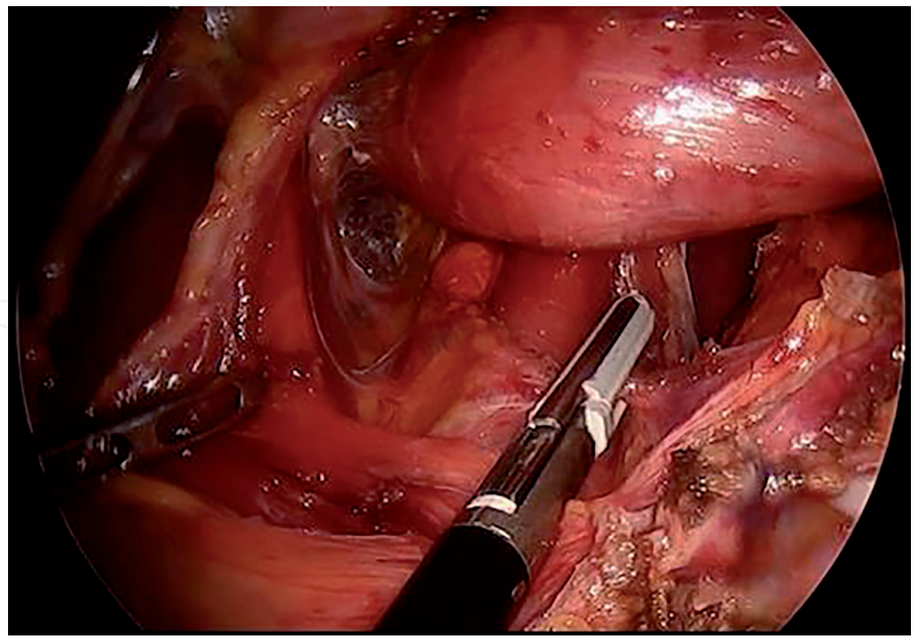

Figure 5.
Hiatal hernia dissection.

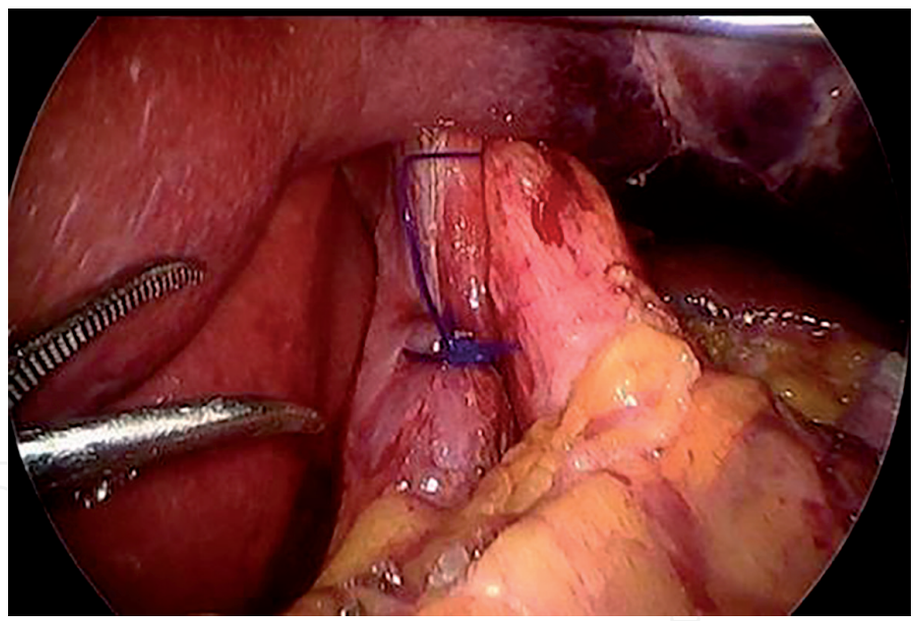

Figure 6.
Repaired hiatal hernia.

2.4 Postoperative care

Patients are encouraged to ambulate and use incentive spirometry. Intravenous fluid is kept until the next day, and the VTE prophylaxis is started 12 h from surgery. A contrast study is done to assess for any leaks or obstructions. If the contrast study is unremarkable, feeding with clear liquids is resumed. A clear discharge plan summarizing the diet program, medications, and follow-up appointments are described to the patient before leaving the hospital.

2.5 Outcome

As mentioned previously, revision of AGB is inevitable due to different indications. Even if the revision indication was band intolerance or slippage, removing the band only and not conducting another revisional surgery will likely lead to regaining weight. This observation was evident even in patients who follow a healthy diet and perform adequate exercises [16, 18]. Close follow-up for patients who underwent AGB removal and did not have weight regain/insufficient weight loss is crucial to prevent weight regain. There are diverse definitions of bariatric surgery failures from a weight loss perspective that can be used to indicate revision [19]. In the case of weight regain or insufficient weight loss, the type of revisional surgery is debated in the literature, with LSG and RYGB showing comparable results from excessive weight loss and resolution of comorbidities [20, 21]. Various factors can influence the decision on what kind of revision be conducted, including the patient's preference. Since LSG is undoubtfully less demanding from a technical point of view, we suggest choosing it as the revisional surgery for AGB as long as it is safe to be performed and there are no concerns of postoperative issues (severe reflux or band erosion). If severe reflux is evident by EGD (LA classification grade B/C) or band erosion was discovered preoperatively, the choice of RYGB is more appropriate than LSG. Performing the revision as one-stage versus two-stage is also an area of debate, especially with regards to anastomotic/staple line leak. Thickening of the stomach wall and the adherent capsule associated with the band are possible reasons behind the fear of performing the revision in one-stage. Staple line leak rate in one stage revision to LSG ranged from 0 to 6% in selected reports [22–24]. As for revision to RYGB in one-stage, the anastomotic leak rate was around 1% [25, 26]. The decision of one-stage versus two-stage procedure should be taken carefully. A patient's medical background is an important determinant factor. The condition and healthiness of the stomach after band removal should be assessed judiciously. In case of the diseased stomach wall or band erosion, a two-stage procedure might be the safer option [27].

3. Revision of laparoscopic sleeve gastrectomy

Laparoscopic sleeve gastrectomy (LSG) became one of the most common procedures conducted worldwide to combat obesity. Initially, it was introduced as the first-stage of a management plan for highly morbid patients with obesity, where another bariatric surgery is planned after weight loss [28]. Since it is increasing in popularity, an international expert panel consensus was introduced to clarify the indications and standardize the technique. The efficacy of LSG compared to other procedures was evident in the literature on weight loss and treating obesity-related diseases [29, 30]. Recently, the literature began to evaluate the long-term effectiveness (>10 years) of LSG, and it showed promising results [31]. With its relative ease compared to other bariatric surgery and the excellent outcomes, LSG became the most common bariatric procedure conducted worldwide. The exploding number of LSGs conducted will undoubtedly lead to an increased revision rate due to complications or weight loss issues, which are becoming more prevalent in the surgical practice.

3.1 Indication of revision

The failure of LSG from a weight-loss standpoint is multifactorial, including the technique implemented, lifestyle behaviors, and possible sleeve dilatation. The rate

Author	Number of patients	Weight regain/insufficient weight loss	Reflux	Weight regain/insufficient weight loss + reflux	others
Chang et al. [35]	69	28%	68%	0	10%
Poghosyan et al. [36]	72	100%	0	0	0
Mandeville et al. [37]	26	73.1%	7.7%	7.7%	0
Gadiot et al. [38]	44	86.3%	13.6%	0	0
Felsenreich et al. [39]	33	65.6%	34.3%	0	0

Table 2.
Indication of laparoscopic sleeve gastrectomy revision in selected studies.

of weight regain ranges from 530% [32]. Those who gained weight after an effective restrictive procedure will benefit from the addition of a malabsorptive feature. Reflux disease is a theoretical consequence of LSG. Since the stomach's lumen decreases in size following the procedure, intraluminal pressure increases, leading to a higher chance of gastric secretions backflow to the esophagus [33]. This phenomenon translates to what is known as de novo reflux disease, and it can be significant to the extent of intolerability affecting a patient's quality of life. Following LSG, the chance of hiatal hernia development is noteworthy and can potentiate reflux, which needs to be ruled out by EGD [34]. If the fundus is not resected while conducting LSG, it can also be a culprit in post LSG reflux disease, which an upper contrast study or EGD can discover (**Table 2**) [40]. In case of a twist or a stricture of the sleeve that is not amenable to stent or dilation, conversion to bypass is the best option (**Figure 7**).

3.2 Preoperative workup

It is essential to evaluate the pre-LSG weight and how much weight was lost during the patient's interview. Evaluating a patient's perspective about the reasons for bariatric surgery failure is crucial. If bad dietary habits were the main reason, consulting a dietician for education will help lose weight and maintain the loss after revisional surgery. All

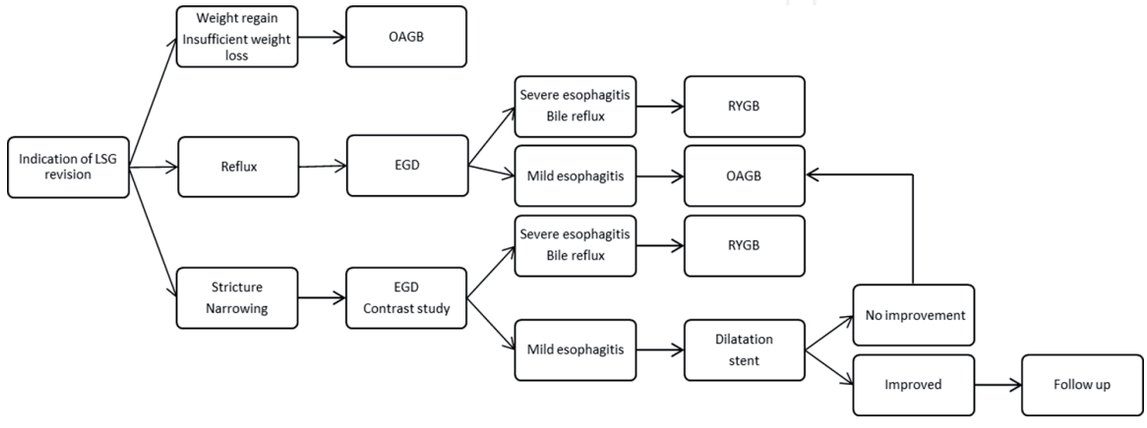

Figure 7.
Suggested pathway decision for sleeve gastrectomy revision.

patients should undergo an upper GI contrast study to evaluate the status of the sleeve, if dilatation is present, remnant fundus or if there is a twist. Reflux symptoms (heartburn, frequent cough/choking, and using proton pump inhibitors) will require EGD. If there is a consequence of the reflux in the form of esophagitis, then offering RYGB is a safe option. In case of hiatal hernia discovery that can explain the reflux, OAGB can be offered but with a risk of reflux up to 30% in the postoperative period. If the patient is eligible for OAGB, it is essential to mention that reflux can occur after OAGB that can be controlled by avoiding reflux aggravators (large meals, spicy foods, and lying down after meals) and healthy eating habits. In case of biliary reflux, the safest option is RYGB. **Figure 5** provides a suggested management plan for the revision of LSG.

3.3 The operation

Preoperative preparations are followed similar to the previous section. After safe entry to the abdomen, we start counting the bowel, first starting from the duodenojejunal junction. If the patient's BMI is less than 40 kg/m^2, 150 cm of the bowel is bypassed. If the BMI is more than 40 kg/m^2, 180 cm of the bowel is bypassed. That point is labeled with clips. Adhesions are released from the area of previous stapling till the GEJ. The assessment for any hiatal hernia is critical. Repair of hiatal hernia is accomplished by anterior and posterior nonabsorbable monofilament sutures. At the incisura and below the crow's feet, we recommend the horizontal transection of the stomach with the highest stapling available (i.e., black reload) (**Figure 8**). A 36F bougie is introduced, and the pouch should be resized when applicable, avoiding narrowing the lumen (**Figure 9**). In preparation for the anastomosis, an enterotomy and gastrotomy are made. The gastrotomy should be made at the posterior aspect of the stomach to prevent bile reflux (**Figure 10**). An ante-colic gastrojejunostomy is constructed by a stapler fired at the 3 cm point joining the two lumens, then closing the defect with a 3-0 continuous absorbable suture in a double layer fashion (**Figure 11**). We highly recommend fixing the gastric pouch by omentopexy. Alignment stitches should be utilized to align and fix the anastomosis to prevent any kink or twist.

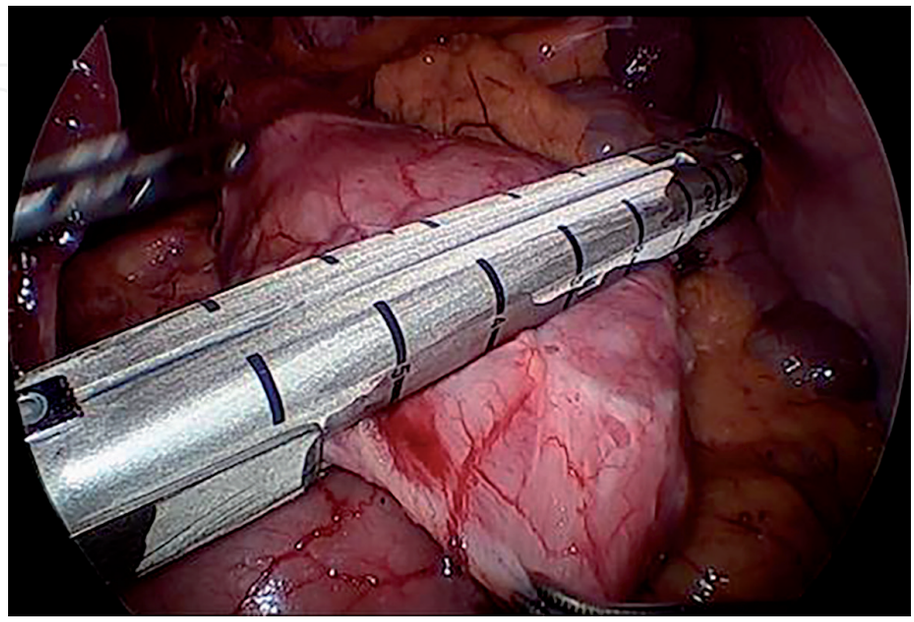

Figure 8.
Horizontal division of the sleeved stomach.

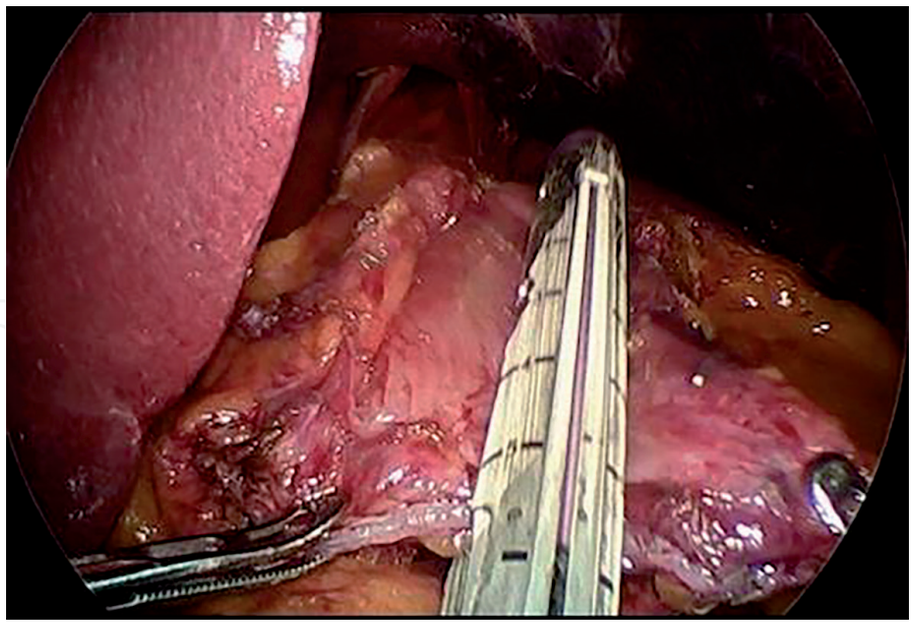

Figure 9.
Resizing the gastric pouch under the guidance of 36Fr bougie.

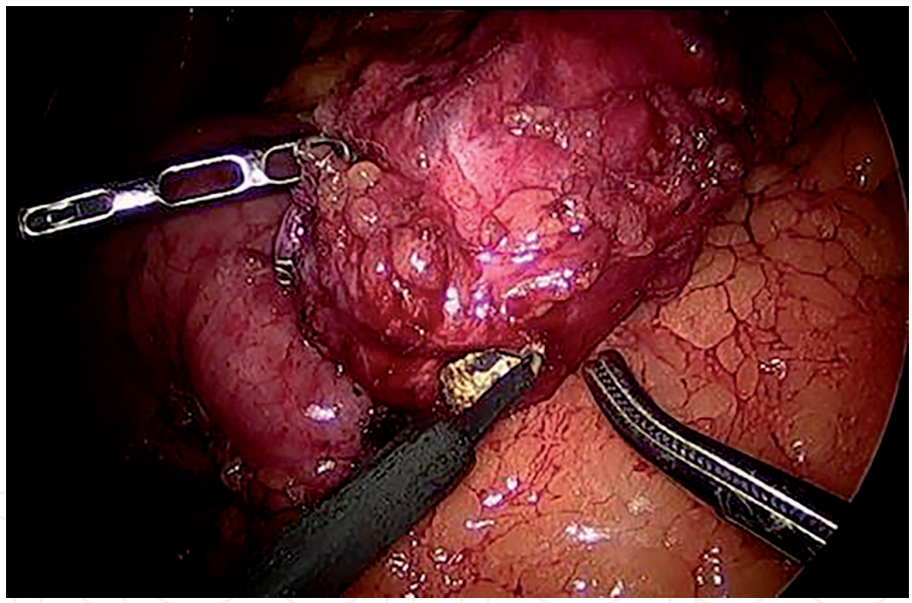

Figure 10.
A gastrotomy is made at the posterior aspect of the gastric pouch.

If the decision is to convert to RYGB, we highly recommend counting the whole bowel first. After forming the gastric pouch, a 120 cm alimentary limb is anastomosed to the pouch with a gastrojejunostomy technique similar to what was mentioned previously. A side-to-side jejunojejunostomy is made with 80–100 cm biliopancreatic limb. It is vital to allow an adequate common channel length to lower the risk of malabsorption. All mesenteric defects must be closed to prevent internal hernias. In case of a twist or stricture, and the decision to go for a bypass, it is important to make the GJ anastomosis above the stricture because the blood supply to that segment might be insufficient, which might threaten the anastomosis viability (**Figures 12** and **13**).

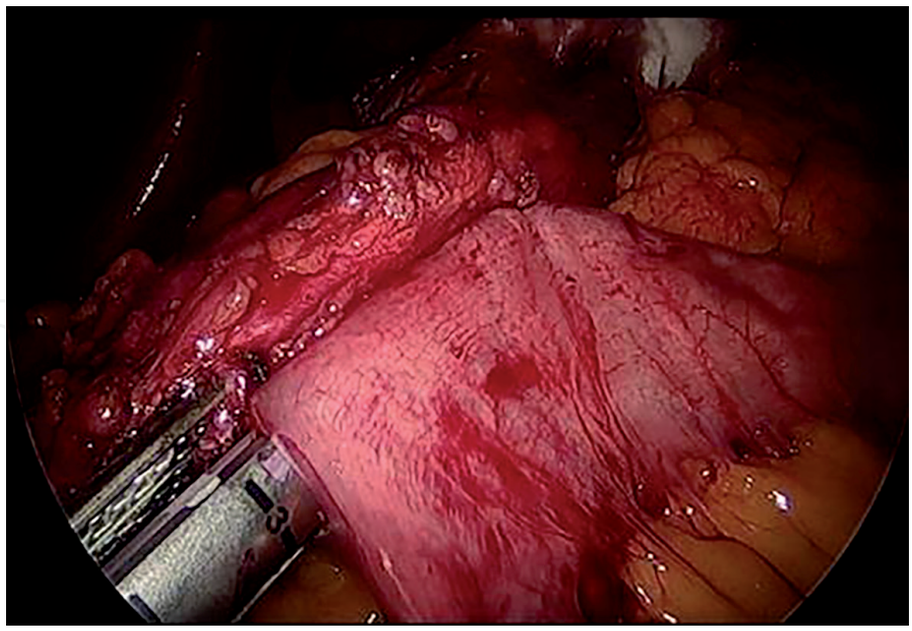

Figure 11.
A gastrojejunostomy is constructed at the 30 mm mark using a 60 mm stapler.

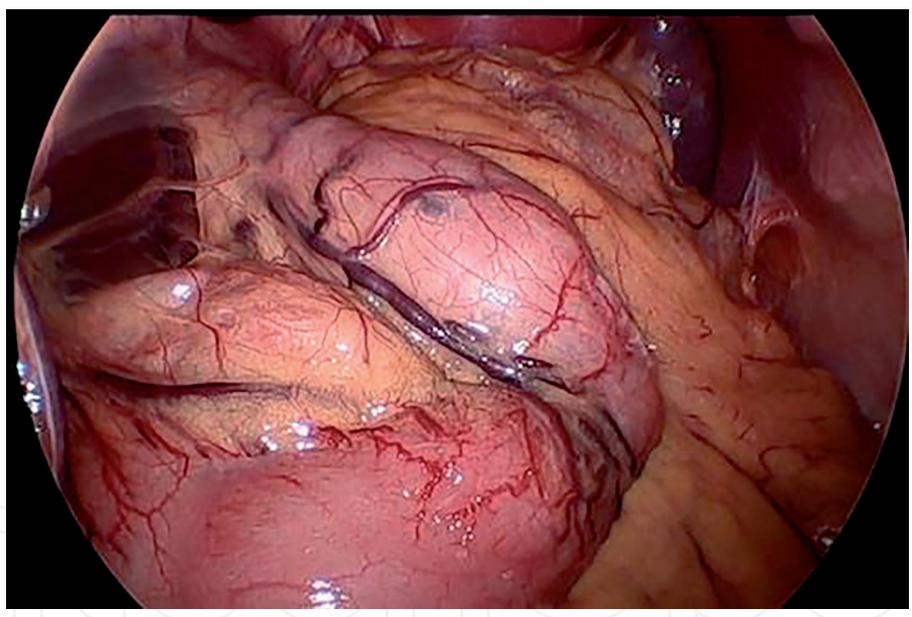

Figure 12.
Twist of the stomach after sleeve gastrectomy.

3.4 Postoperative care

Intravenous fluid should be kept on the first day until the upper GI study confirms free-flowing contrast through the anastomosis, with no interruption or delay of the flow. This is critical, especially after concomitant hiatal hernia repair. Ambulation and incentive spirometry use are necessary to be reminded by the managing team. Anticoagulant medications should be resumed based on the guidelines followed. Before discharge, instructions about diet progression, activity, and specific ominous symptoms requiring attention are explained to the patient.

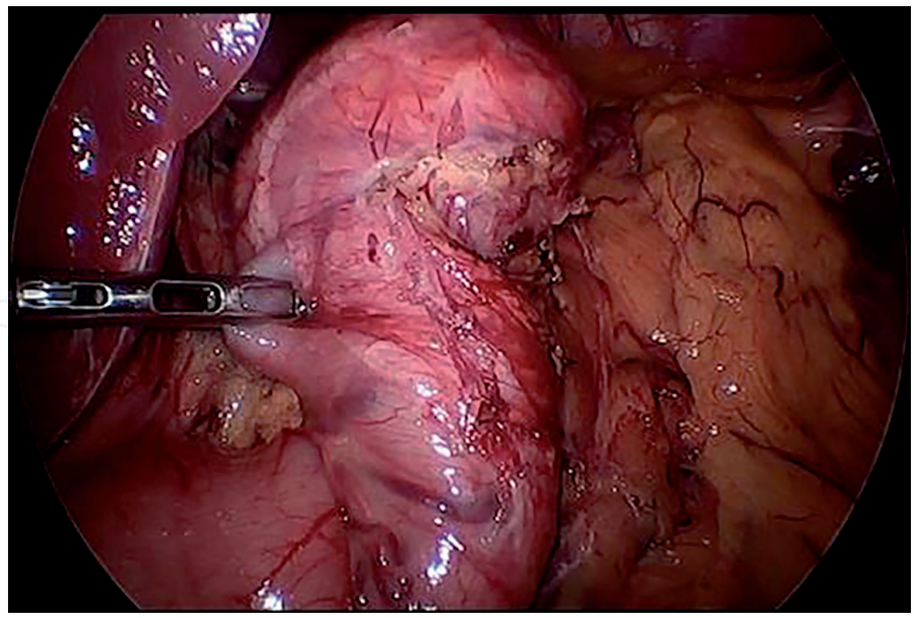

Figure 13.
Twisted sleeve. The dashed line illustrates the unequal stapling.

3.5 Outcome

The success of LSG in weight loss depends on several factors. Some are related to the technique conducted, like the size of the bougie used and the distance from the pylorus where the first stapler is applied [41]. Restricting oral intake is not only the reason for weight loss, but also LSG affects the hormones of interest involved in weight and hunger. The ghrelin level drops significantly postoperatively by removing the fundus, and the peptide YY (PYY) gets considerable elevation after the surgery. This observation probably explains the rapid satiety and hunger reduction during the early years after LSG [42]. Following dietary instructions and avoiding a sedentary lifestyle are key components of success [43]. As long as the procedure is done properly, predictors of weight regain/insufficient weight loss following LSG can be related mainly to dietary misbehavior and nonadherence to instructions [44]. Since restriction has failed in patients with WR/IWL following LSG, a rational strategy is adding a malabsorptive element in the surgical management. The classic revision of LSG is to convert to RYGB, but the OAGB seems to be a strong contender for two main reasons (**Table 3**). First, OAGB showed a comparative efficacy to RYGB as a rescue procedure, with less operative time and fewer complications [49]. Second, more options for managing weight recidivism can be achieved by adding a procedure before RYGB, which is the OAGB. In case OAGB fails, it can be converted smoothly to RYGB.

There are critiques mentioned in the literature expressing the disapproval of OAGB in some aspects. One of these remarks is the fear of bile reflux and the subsequent continuous esophageal irritation, which is worrisome. This is possible if the gastric pouch is short, increasing the chance of bile backflow to the stomach and ultimately in the esophagus. Keeping the gastric pouch long is critical to prevent the feared bile reflux, and being liberal in using "alignment stitches" or the so called "anti-reflux stitches" to prevent kinks or twists are critical elements in the procedure (**Figure 10**) [50, 51]. After improving the technique of the OAGB procedure, the rate of bile reflux following OAGB is reported to be around 0.7–2%[52, 53].

Author	Number of patients	Indication of revision	Time until revision (years)	Follow-up rate	Excessive weight loss	Length of BPL
Poghosyan et al [36]	72	IWL WR	NA	65% (5 year)	60% (1 year)	150, 200 cm
Gregs et al [45]	28	IWL 53% WR 46%	2 years	100% (1 year)	79% (1 year)	200 cm
Pizza et al [46]	59	IWL 20% WR 79%	2 years	NA	69%	200–220 cm
Poublon et al [47]	65	IWL 30% WR 56%	NA	83% (1 year)	NA	180 cm
Rayman et al [48]	144	IWL 79% WR 20%	5 years	NA	58%	NA

Table 3.
Outcome following revision of sleeve gastrectomy to one anastomosis gastric bypass.

A large portion of the bariatric community classifies OAGB as a malabsorptive procedure. Malnutrition became an issue because the bypassed BPL can be as long as 300 cm in some practices. Reports showed severe nutritional deficiencies, hypoalbuminemia, and liver failure [54, 55]. In a survey conducted targeting IFSO members, all revisions due to malnutrition occurred when the BPL was 200 cm or more [56]. Because of OAGB's simplicity, the length of BPL is the only possible reason for this outcome. It seems that elongating the BPL is not beneficial from a weight-loss standpoint and endangers the patient with malnutrition and its dreadful consequences. Recently, it has been highly recommended not to exceed 180 cm of BPL length in order to prevent malnutrition, and at the same time, this limit will not compromise weight loss [55, 57].

The rate of reported GERD development after LSG ranged from 7.8 to 20%. It could be the consequence of fibers/ligaments division near the gastroesophageal junction, which alters and nullifies the angle of his features in protecting from reflux. Other factors include increased pressure because of the lumen narrowing or missing a hiatal hernia [58]. Unfortunately, when reflux develops after LSG due to a hiatal hernia, simply repairing the hiatal hernia showed disappointing results [59]. The applicability of OAGB in the treatment of reflux is a valid option in certain situations. If there is no severe reflux or Barret's esophagus on endoscopy, OAGB is a suitable option [60]. Clear communication with the patient about the possible recurrence of manageable reflux postoperatively is necessary.

4. Revision of Roux-en-Y gastric bypass

Since several decades ago, laparoscopic Roux-en-Y gastric bypass (RYGB) is still a valuable tool in the bariatric surgeon's arsenal. It has a unique configuration where it implements a restrictive mechanism by dividing the stomach and forming a small gastric pouch. Secondly, RYGB involves bypassing some of the small bowels by constructing the Roux limb/alimentary limb delivering the food and a biliopancreatic limb delivering the pancreaticobiliary juices and meeting at the start of the common channel where most of the absorption takes place. (Wolfe) The length of each limb is variable, and there is no clear consensus about the perfect measurements. However, what is agreed on is the efficacy of RYGB in weight reduction by several other

mechanisms, including changes in eating behavior, the favorable elevation of gut hormones (GLP1 and PPY), and likely beneficial changes in energy expenditure [61]. The efficacy of RYGB was pronounced in the literature. With effective and sustainable weight loss and resolution of comorbidities, it is regarded as one of the most effective procedures to combat obesity and obesity-related diseases [2, 62].

4.1 Indication of revision

Despite the effectiveness of RYGB, sadly, it is not immune to the possibility of revisions. The most typical indication of revision after RYGB is the weight regain. We cannot stress enough the importance of interviewing the patient and evaluating one of the most critical factors contributing to weight-regain: dietary habits and lifestyle. Other possible anatomical causes of weight regain need further evaluation. Additional indications for revisions are bile reflux, which can happen in the case of a short alimentary limb [63]. Patients can complain of GERD symptoms post-RYGB, and the presence of a hiatal hernia; a large gastric pouch producing acid can explain this presentation.

4.2 Preoperative workup

Binge eating and loss of self-control can be significant contributing factors to weight regain following bariatric surgery. This issue can be ameliorated with a behavioral therapist and a qualified dietician [64]. Other aspects contributing to weight regain that are related to surgical factors include the diameter of GJ anastomosis, a gastro-gastric (GG) fistula, or a dilated gastric pouch [65–67]. It is an excellent practice to start with an upper contrast study to evaluate the aforementioned anatomical features. If a suspicion of wide GJ anastomosis or a GG fistula is present, an EGD is recommended [68]. Preoperative nutritional assessment and vitamin level could be valuable (**Figure 14**).

4.3 The operation

The procedure starts with proper and secure patient positioning. Access to the abdomen is achieved using a visiport at 5 cm above and to the left of the umbilicus. Other ports and liver retractors are inserted in a controlled manner. Counting the

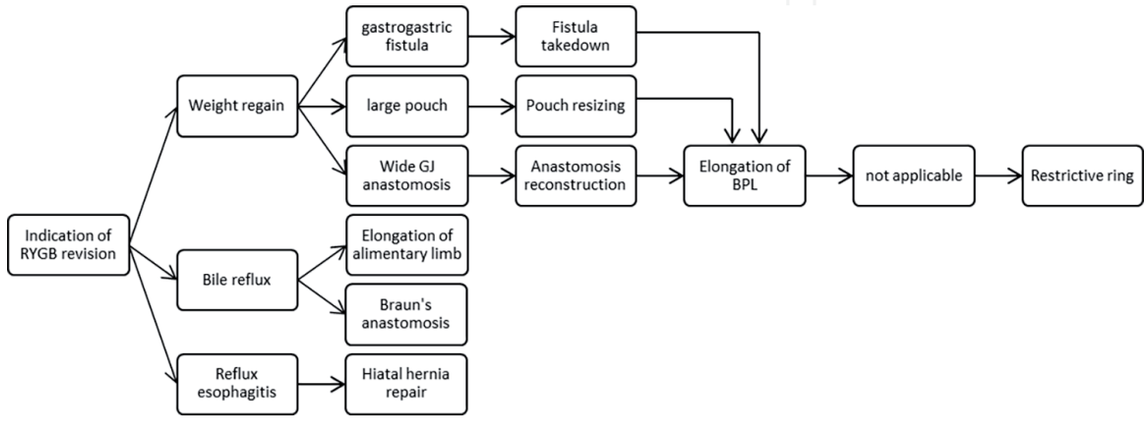

Figure 14.
Suggested pathway decision for revision of Roux-en-Y gastric bypass.

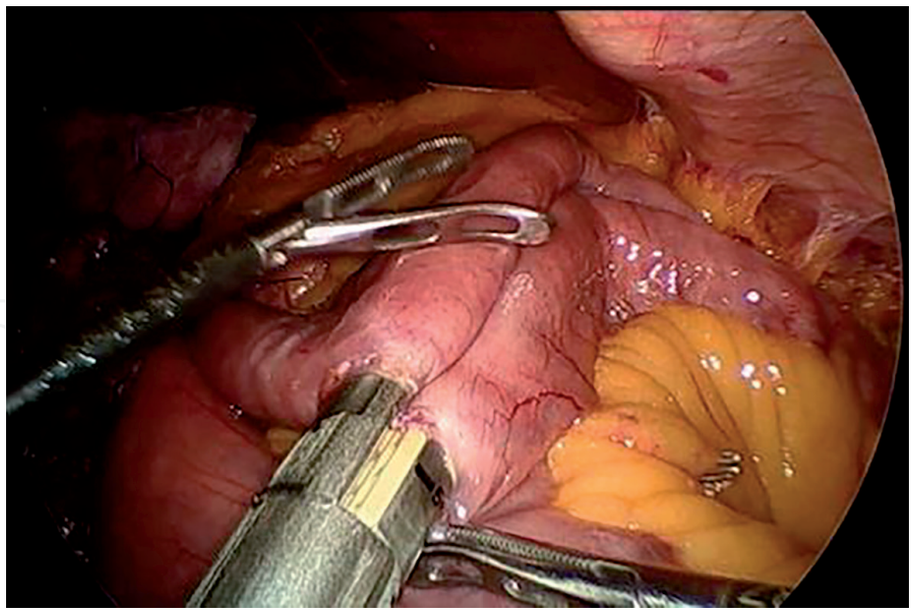

Figure 15.
Constructing a side-to-side jejunojejunostomy.

whole bowel at the beginning of the procedure and writing down the measurements is very helpful in formulating a plan. In case of weight regain, our practice dictates shortening the common channel to not less than five meters. The biliary limb is the one getting elongated. The jejunojejunostomy (JJ) will be divided at the distal end of the alimentary limb and brought down to the marked point of the new anastomosis. Enterotomies are made on the antimesenteric side, and a side-to-side anastomosis is made (**Figure 15**). Closure of the enterotomies is achieved using a double monofilament layer. The mesenteric defects need to be sought out and closed.

Resizing the gastric pouch when applicable is advantageous. In case of extensive adhesions near the gastrojejunostomy, we tend to avoid resizing the pouch if dissection is needed, which might jeopardize blood supply to the GJ anastomosis. It

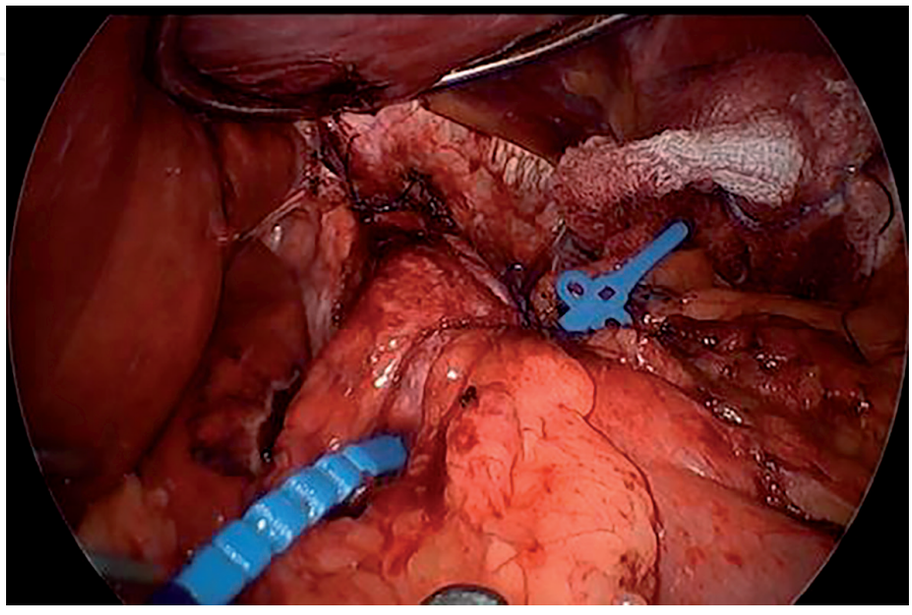

Figure 16.
A nonadjustable gastric band application around the gastric pouch above the gastrojejunostomy.

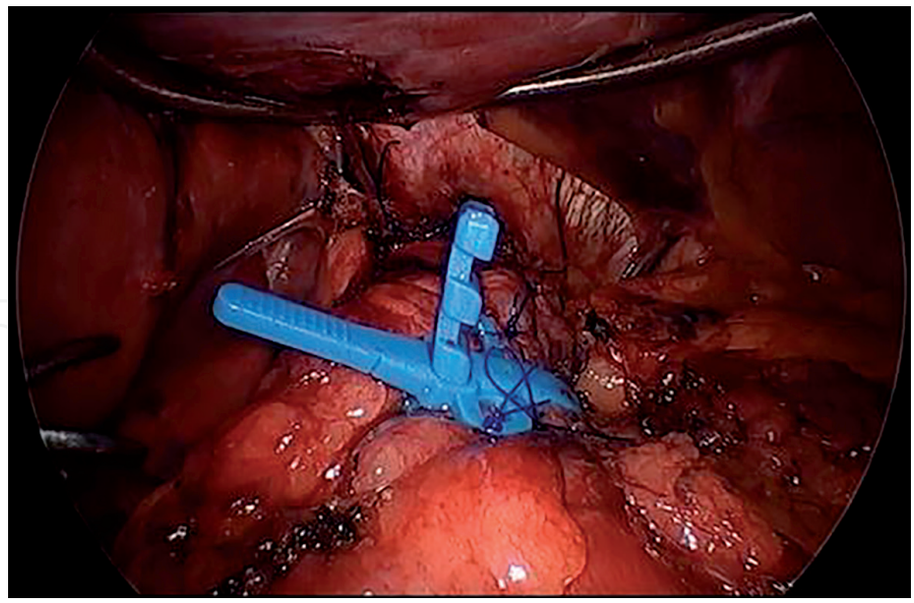

Figure 17.
A nonadjustable band is applied and sutured to the gastric pouch.

is essential to investigate the presence of hiatal hernia intra-operatively even if the preoperative scope did not show any signs of hiatal hernia. If present, the release of adhesions and mobilization of a 2–3 cm intrabdominal esophagus is needed. The hernia is closed using an anterior and posterior monofilament sutures. If the common channel is short and does not allow for JJ distalization, applying a nonadjustable restrictive ring might be applicable. Careful dissection proximal to the GJ anastomosis is needed, and it should be snugly applied with no constriction (**Figures 16** and **17**).

4.4 Postoperative care

According to the protocol, we tend to delay oral intake until oral contrast assures normal flowing contrast with no delays or leakage. After that, clear liquids can be started. Ambulation and respiratory exercise are crucial. Resumption of anticoagulants is started around 12 h after surgery and continued for 2–3 weeks after surgery. Instructions and education before discharge are given, with follow-up appointments and contact numbers in case of emergency.

4.5 Outcome

Since its introduction, RYGB has helped patients with obesity to lose weight and control their comorbidities. Changes in eating habits, food preferences, and hormonal changes are some of the mechanisms explaining the procedure's efficacy [69]. Although less technically demanding procedures are available, RYGB is still considered the preferable procedure in some areas worldwide. Several reports demonstrated the efficacy of RYGB and its durability from a weight-loss standpoint over 10 years, with a total weight reduction of >25% in 61–71% of patients [70–72]. Despite that, weight regain can happen regardless of the type of weight-reducing surgery. Around 30% of patients with obesity subjected to LRYGB had weight regain, and the cause seems multifactorial, including patient-related causes (binge eating and sedentary lifestyle) and elapsed time since surgery [73, 74].

Different approaches can be employed when revising the RYGB after weight-regain or insufficient weight loss. These include modification of bowel length, resizing the gastric pouch, applying a restrictive band, or a combination of these interventions.

4.5.1 Bowel length adjustments

Shortening the common channel to augment the malabsorptive component of RYGB is an intuitive option. Since the configuration of RYGB results in a different type of bowel based on what they deliver, two options arise that leads to shortening the common channel. Firstly, is elongating the Roux limb that ends with shortening of the common channel, and the biliary limb is not affected [75]. Although excess weight loss was excellent with this technique, the risk of nutritional deficiency and protein malabsorption was frequent [76]. The second option is elongating the biliary limb by shortening the common channel [77, 78]. This results in less but effective weight loss, with less risk of malnutrition. There is no consensus on which procedure is optimal, and both procedures are adequate. However, what is essential is to avoid detrimental nutritional deficiency and malnutrition. This can be achieved by measuring the bowel length and ensuring adequate bowel length for nutrient absorption. A total alimentary limb (the sum of Roux limb and common channel) of more than four to five meters is adequate to avoid malnutrition [79].

4.5.2 Resizing the gastric pouch only

Focusing on enhancing the restrictive part of RYGB seems a safe and valid decision for the management of weight regain. The option includes either stapling the gastric pouch, the GJ anastomosis or both, to reduce the volume [80]. The other method is the plication of the gastric pouch under the guidance of a bougie [81]. It is crucial to evaluate the effect of remnant candy cane that might increase the volume of the oral intake. Resizing the gastric pouch not only augments the restrictive nature of RYGB but also reduces GERD by eliminating more of the acid-producing cells [82].

4.5.3 Application of restrictive band

Bad eating habits can ensue after RYGB, probably due to the direct flow of food to the bowel. The size of the GJ anastomosis could be implicated in this phenomenon. Applying a band around the gastric pouch can prevent this hyperphagia through a simple restriction. Both types of band, that is, adjustable and nonadjustable, were examined and showed varying degrees of weight loss. In our opinion, band application seems less attractive compared to the remaining options because of the possible band complications (erosion and slippage) [83, 84].

Other available options include endoluminal revision, which has the lowest weight reduction compared to the other means [85, 86]. A combination of the options mentioned above is potentially valuable to maximize the chance of weight reduction. Careful patient selection and patient commitment are crucial to success.

5. Patient's compliance

Resolving obesity can be achieved by constructing a management plan between the surgeon and the patient. This plan includes several elements: the surgery,

the follow-up appointments, and compliance with the instructions. These elements collectively contribute to weight loss and sustain the loss most of the time. Unfortunately, some patients fail to follow the plan recommended and end up with weight regain. Patients compliant with the follow-up appointment have better outcomes and more sustainability of weight loss. This is true because the surgeon can keep up with the patient's progress, catch any derails from the management plan, and correct any mistakes that might hinder achieving the goals [87].

The managing team should seek the possibility of the patient's noncompliance during the preoperative interview. Any indication of an eating disorder (binge eating and anorexia nervosa) should trigger a referral to a behavioral therapist before surgery. Patients with eating disorders have a high chance of failure if not addressed and managed preoperatively [88]. It is crucial to clarify to the patient that bariatric surgeries are a tool to help in weight loss with excellent efficacy. However, keeping a healthy lifestyle and good dietary habits is vital and should not be undermined.

6. Conclusion

Bariatric surgery is an effective tool to manage obesity, reverse obesity-related comorbidities, and improve quality of life. Weight regain or surgical complication following bariatric surgery is not uncommon. The appropriate approach for those patients who were unfortunate with their results should be thorough and systematic. A multidisciplinary team comprising the surgeon, an internist, a behavioral therapist, and a qualified dietician is highly recommended. These patients need complete investigation to assess their suitability for any potential surgical intervention. Patient participation in the management plan by following the instruction and changing lifestyle habits is crucial.

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References

[1] Smith KB, Smith MS. Obesity statistics. Primary Care: Clinics in Office Practice. 2016;**43**(1):121-135

[2] Schauer PR, Bhatt DL, Kirwan JP, Wolski K, Aminian A, Brethauer SA, et al. Bariatric surgery versus intensive medical therapy for diabetes—5-year outcomes. The New England Journal of Medicine. 2017;**376**:641-651

[3] Buchwald H. Introduction and current status of bariatric procedures. Surgery for Obesity and Related Diseases. 2008;**4**(3):S1-S6

[4] O'Brien PE, MacDonald L, Anderson M, Brennan L, Brown WA. Long-term outcomes after bariatric surgery: Fifteen-year follow-up of adjustable gastric banding and a systematic review of the bariatric surgical literature. Annals of Surgery. 2013;**257**(1):87-94

[5] O'Brien PE, Brennan L, Laurie C, Brown W. Intensive medical weight loss or laparoscopic adjustable gastric banding in the treatment of mild to moderate obesity: Long-term follow-up of a prospective randomised trial. Obesity Surgery. 2013;**23**(9):1345-1353

[6] Furbetta N, Gragnani F, Flauti G, Guidi F, Furbetta F. Laparoscopic adjustable gastric banding on 3566 patients up to 20-year follow-up: Long-term results of a standardized technique. Surgery for Obesity and Related Diseases. 2019;**15**(3):409-416

[7] Opozda M, Wittert G, Chur-Hansen A. Patients* reasons for and against undergoing Roux-en-Y gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy. Surgery for Obesity and Related Diseases. 2017;**13**(11):1887-1896

[8] Nguyen NT, Kim E, Vu S, Phelan M. Ten-year outcomes of a prospective randomized trial of laparoscopic gastric bypass versus laparoscopic gastric banding. Annals of Surgery. 2018;**268**(1):106

[9] Lee JH, Nguyen QN, Le QA. Comparative effectiveness of 3 bariatric surgery procedures: Roux-en-Y gastric bypass, laparoscopic adjustable gastric band, and sleeve gastrectomy. Surgery for Obesity and Related Diseases. 2016;**12**(5):997-1002

[10] Carlin AM, Zeni TM, English WJ, Hawasli AA, Genaw JA, Krause KR, et al. The comparative effectiveness of sleeve gastrectomy, gastric bypass, and adjustable gastric banding procedures for the treatment of morbid obesity. Annals of Surgery. 2013;**257**(5):791-797

[11] Shen X, Zhang X, Bi J, Yin K. Long-term complications requiring reoperations after laparoscopic adjustable gastric banding: A systematic review. Surgery for Obesity and Related Diseases. 2015;**11**(4):956-964

[12] Emous M, Apers J, Hoff C, Van Beek AP, Totté E. Conversion of failed laparoscopic adjustable gastric banding to Roux-en-Y gastric bypass is safe as a single-step procedure. Surgical Endoscopy. 2015;**29**(8):2217-2223

[13] Yeung L, Durkan B, Barrett A, Kraft C, Vu K, Phillips E, et al. Single-stage revision from gastric band to gastric bypass or sleeve gastrectomy: 6- and 12-month outcomes. Surgical Endoscopy. 2016;**30**(6):2244-2250

[14] Falk V, Sheppard C, Kanji A, Birch D, Karmali S, de Gara C. The fate of laparoscopic adjustable gastric band removal. Canadian Journal of Surgery. 2019;**62**(5):328

[15] Jaber J, Glenn J, Podkameni D, Soto F. A 5-year history of laparoscopic gastric band removals: An analysis of complications and associated comorbidities. Obesity Surgery. 2019;**29**(4):1202-1206

[16] Kirshtein B, Kirshtein A, Perry Z, Ovnat A, Lantsberg L, Avinoach E, et al. Laparoscopic adjustable gastric band removal and outcome of subsequent revisional bariatric procedures: A retrospective review of 214 consecutive patients. International Journal of Surgery. 2016;**27**:133-137

[17] Nocca D, Frering V, Gallix B, des Hons CD, Noël P, Foulonge MA, et al. Migration of adjustable gastric banding from a cohort study of 4236 patients. Surgical Endoscopy and other Interventional Techniques. 2005;**19**(7):947-950

[18] Aarts EO, Dogan K, Koehestanie P, Janssen IM, Berends FJ. What happens after gastric band removal without additional bariatric surgery. Surgery for Obesity and Related Diseases. 2014;**10**(6):1092-1096

[19] Mann JP, Jakes AD, Hayden JD, Barth JH. Systematic review of definitions of failure in revisional bariatric surgery. Obesity surgery. 2015 Mar;**25**(3):571-574

[20] Moon RC, Teixeira AF, Jawad MA. Conversion of failed laparoscopic adjustable gastric banding: sleeve gastrectomy or Roux-en-Y gastric bypass?. Surgery for Obesity and Related Diseases. 2013 Nov 1;**9**(6):901-907

[21] Angrisani L, Vitiello A, Santonicola A, Hasani A, De Luca M, Iovino P. Roux-en-Y gastric bypass versus sleeve gastrectomy as revisional procedures after adjustable gastric band: 5-year outcomes. Obesity Surgery. 2017 Jun;**27**(6):1430-1477

[22] Pencovich N, Lahat G, Goldray O, Abu-Abeid S, Klausner JM, Meron Eldar S. Safety and outcome of laparoscopic sleeve gastrectomy following removal of adjustable gastric banding: lessons from 109 patients in a single center and review of the literature. Obesity surgery. 2017 May;**27**(5):1266-1270

[23] Alqahtani AR, Elahmedi M, Alamri H, Mohammed R, Darwish F, Ahmed AM. Laparoscopic removal of poor outcome gastric banding with concomitant sleeve gastrectomy. Obesity surgery. 2013 Jun;**23**(6):782-787

[24] Acholonu E, McBean E, Bellorin O, Szomstein S, Rosenthal RJ. Safety and short-term outcomes of laparoscopic sleeve gastrectomy as a revisional approach for failed laparoscopic adjustable gastric banding in the treatment of morbid obesity. Obesity surgery. 2009 Dec;**19**(12):1612-1616

[25] Marin-Perez P, Betancourt A, Lamota M, Lo Menzo E, Szomstein S, Rosenthal R. Outcomes after laparoscopic conversion of failed adjustable gastric banding to sleeve gastrectomy or Roux-en-Y gastric bypass. Journal of British Surgery. 2014 Feb;**101**(3):254-260

[26] Aarts E, Koehestanie P, Dogan K, Berends F, Janssen I. Revisional surgery after failed gastric banding: results of one-stage conversion to RYGB in 195 patients. Surgery for Obesity and Related Diseases. 2014 Nov 1;**10**(6):1077-1083

[27] Super J, Charalampakis V, Tahrani AA, Kumar S, Bankenahally R, Raghuraman G, et al. Safety and feasibility of revisional bariatric surgery following Laparoscopic Adjustable Gastric Band–Outcomes from a large UK private practice. Obesity research & clinical practice. 2021 Jul 1;**15**(4):381-386

[28] Cottam D, Qureshi FG, Mattar SG, Sharma S, Holover S, Bonanomi G, et al. Laparoscopic sleeve gastrectomy as an initial weight-loss procedure for high-risk patients with morbid obesity. Surgical

Endoscopy and Other Interventional Techniques. 2006 Jun;**20**(6):859-863

[29] Trastulli S, Desiderio J, Guarino S, Cirocchi R, Scalercio V, Noya G, et al. Laparoscopic sleeve gastrectomy compared with other bariatric surgical procedures: a systematic review of randomized trials. Surgery for obesity and related diseases. 2013 Sep 1;**9**(5):816-829

[30] Shenoy SS, Gilliam A, Mehanna A, Kanakala V, Bussa G, Gill T, et al. Laparoscopic sleeve gastrectomy versus laparoscopic Roux-en-Y Gastric bypass in elderly bariatric patients: safety and efficacy—a systematic review and meta-analysis. Obesity surgery. 2020 Nov;**30**(11):4467-4473

[31] Kraljević M, Cordasco V, Schneider R, Peters T, Slawik M, Wölnerhanssen B, et al. Long-term effects of laparoscopic sleeve gastrectomy: what are the results beyond 10 years?. Obesity Surgery. 2021 Aug;**31**(8):3427-3433

[32] Lauti M, Kularatna M, Hill AG, MacCormick AD. Weight regain following sleeve gastrectomy—a systematic review. Obesity surgery. 2016 Jun;**26**(6):1326-1334

[33] Chern TY, Chan DL, Maani J, Ferguson JS, Talbot ML. High-resolution impedance manometry and 24-hour multichannel intraluminal impedance with pH testing before and after sleeve gastrectomy: de novo reflux in a prospective series. Surgery for Obesity and Related Diseases. 2021 Feb 1;**17**(2):329-337

[34] Saba J, Bravo M, Rivas E, Fernández R, Pérez-Castilla A, Zajjur J. Incidence of de novo hiatal hernia after laparoscopic sleeve gastrectomy. Obesity Surgery. 2020 Oct;**30**(10):3730-3734

[35] Chang DM, Lee WJ, Chen JC, Ser KH, Tsai PL, Lee YC. Thirteen-year experience of laparoscopic sleeve gastrectomy: Surgical risk, weight loss, and revision procedures. Obesity Surgery. 2018;**28**(10):2991-2997. Epub 2018/06/23. DOI: 10.1007/s11695-018-3344-3

[36] Poghosyan T, Alameh A, Bruzzi M, Faul A, Rives-Lange C, Zinzindohoue F, et al. Conversion of sleeve gastrectomy to one anastomosis gastric bypass for weight loss failure. Obesity Surgery. 2019;**29**(8):2436-2441. Epub 2019/04/05. DOI: 10.1007/s11695-019-03864-x

[37] Mandeville Y, Van Looveren R, Vancoillie PJ, Verbeke X, Vandendriessche K, Vuylsteke P, et al. Moderating the enthusiasm of sleeve gastrectomy: Up to fifty percent of reflux symptoms after ten years in a consecutive series of one hundred laparoscopic sleeve gastrectomies. Obesity Surgery. 2017;**27**(7):1797-1803. Epub 2017/02/13. DOI: 10.1007/s11695-017-2567-z

[38] Gadiot RPM, Biter LU, van Mil S, Zengerink HF, Apers J, Mannaerts GHH. Long-term results of laparoscopic sleeve gastrectomy for morbid obesity: 5 to 8-Year Results. Obesity Surgery. 2017;**27**(1):59-63. DOI: 10.1007/s11695-016-2235-8

[39] Felsenreich DM, Langer FB, Kefurt R, Panhofer P, Schermann M, Beckerhinn P, et al. Weight loss, weight regain, and conversions to Roux-en-Y gastric bypass: 10-year results of laparoscopic sleeve gastrectomy. Surgery for Obesity and Related Diseases. 2016;**12**(9):1655-1662. Epub 2016/06/19. DOI: 10.1016/j.soard.2016.02.021

[40] Daes J, Jimenez ME, Said N, Daza JC, Dennis R. Laparoscopic sleeve gastrectomy: symptoms of gastroesophageal reflux can be reduced by changes in surgical technique. Obesity surgery. 2012 Dec;**22**(12):1874-1879

[41] Abd Ellatif ME, Abdallah E, Askar W, Thabet W, Aboushady M, Abbas AE, et al. Long term predictors of success after laparoscopic sleeve gastrectomy. International journal of surgery. 2014 May 1;**12**(5):504-508

[42] Karamanakos SN, Vagenas K, Kalfarentzos F, Alexandrides TK. Weight loss, appetite suppression, and changes in fasting and postprandial ghrelin and peptide-YY levels after Roux-en-Y gastric bypass and sleeve gastrectomy: a prospective, double blind study. Annals of surgery. 2008 Mar 1;**247**(3):401-407

[43] Keren D, Matter I, Lavy A. Lifestyle modification parallels to sleeve success. Obesity surgery. 2014 May;**24**(5):735-740

[44] Yu Y, Klem ML, Kalarchian MA, Ji M, Burke LE. Predictors of weight regain after sleeve gastrectomy: an integrative review. Surgery for Obesity and Related Diseases. 2019 Jun 1;**15**(6):995-1005

[45] Gerges WB, Omran H, Makram F. Conversion of laparoscopic sleeve gastrectomy after weight loss failure into laparoscopic one anastomosis gastric bypass: short-term safety and efficacy and effect of indications on outcome. Surgical Endoscopy. 2022 Feb;**36**(2):1080-1089

[46] Pizza F, D'Antonio D, Carbonell Asins JA, Lucido FS, Tolone S, Docimo L, et al. One anastomosis gastric bypass after sleeve gastrectomy failure: Does a single procedure fit for all. Obesity Surgery. 2021;**31**(4):1722-1732. Epub 2021/01/05. DOI: 10.1007/s11695-020-05191-y

[47] Poublon N, Chidi I, Bethlehem M, Kuipers E, Gadiot R, Emous M, et al. One anastomosis gastric bypass vs. Roux-en-Y gastric bypass, remedy for insufficient weight loss and weight regain after failed restrictive bariatric surgery. Obesity Surgery. 2020;**30**(9):3287-3294. Epub 2020/04/21. DOI: 10.1007/s11695-020-04536-x

[48] Rayman S, Assaf D, Azran C, Sroka G, Assalia A, Beglaibter N, et al. Sleeve gastrectomy failure-revision to laparoscopic one-anastomosis gastric bypass or Roux-n-Y gastric bypass: A multicenter study. Obesity Surgery. 2021;**31**(7):2927-2934. Epub 2021/03/26. DOI: 10.1007/s11695-021-05334-9

[49] Chiappetta S, Stier C, Scheffel O, Squillante S, Weiner RA. Mini/one anastomosis gastric bypass versus Roux-en-Y gastric bypass as a second step procedure after sleeve gastrectomy—a retrospective cohort study. Obesity Surgery. 2019 Mar;**29**(3):819-827

[50] Luque-de-León E, Carbajo MA. Conversion of one-anastomosis gastric bypass (OAGB) is rarely needed if standard operative techniques are performed. Obesity surgery. 2016 Jul;**26**(7):1588-1591

[51] Musella M, Susa A, Manno E, De Luca M, Greco F, Raffaelli M, et al. Complications following the mini/one anastomosis gastric bypass (MGB/OAGB): A multi-institutional survey on 2678 patients with a mid-term (5 years) follow-up. Obesity Surgery. 2017;**27**(11):2956-2967. Epub 2017/06/02. DOI: 10.1007/s11695-017-2726-2

[52] Georgiadou D, Sergentanis TN, Nixon A, Diamantis T, Tsigris C, Psaltopoulou T. Efficacy and safety of laparoscopic mini gastric bypass. A systematic review. Surgery for obesity and related diseases. 2014 Sep 1;**10**(5):984-991

[53] Chevallier JM, Arman GA, Guenzi M, Rau C, Bruzzi M, Beaupel N, et al. One thousand single anastomosis (omega loop) gastric bypasses to treat morbid obesity in a 7-year period: outcomes show

few complications and good efficacy. Obesity surgery. 2015 Jun;**25**(6):951-958

[54] Khalaj A, Kalantar Motamedi MA, Mousapour P, Valizadeh M, Barzin M. Protein-calorie malnutrition requiring revisional surgery after one-anastomosis-mini-gastric bypass (OAGB-MGB): case series from the Tehran Obesity Treatment Study (TOTS). Obesity Surgery. 2019 Jun;**29**(6):1714-1720

[55] Ahuja A, Tantia O, Goyal G, Chaudhuri T, Khanna S, Poddar A, et al. MGB-OAGB: effect of biliopancreatic limb length on nutritional deficiency, weight loss, and comorbidity resolution. Obesity Surgery. 2018 Nov;**28**(11):3439-3445

[56] Haddad A, Bashir A, Fobi M, Higa K, Herrera MF, Torres AJ, et al. The IFSO worldwide one anastomosis gastric bypass survey: techniques and outcomes?. Obesity Surgery. 2021 Apr;**31**(4):1411-1421

[57] Boyle M, Mahawar K. One anastomosis gastric bypass performed with a 150-cm biliopancreatic limb delivers weight loss outcomes similar to those with a 200-cm biliopancreatic limb at 18-24 months. Obesity Surgery. 2020 Apr;**30**(4):1258-1264

[58] Melissas J, Braghetto I, Molina JC, Silecchia G, Iossa A, Iannelli A, et al. Gastroesophageal reflux disease and sleeve gastrectomy. Obesity Surgery. 2015;**25**(12):2430-2435. DOI: 10.1007/s11695-015-1906-1

[59] Soong T-C, Almalki OM, Lee W-J, Ser K-H, Chen J-C, Wu C-C, et al. Revision of sleeve gastrectomy with hiatal repair with gastropexy for gastroesophageal reflux disease. Obesity Surgery. 2019;**29**(8):2381-2386. DOI: 10.1007/s11695-019-03853-0

[60] Mahawar KK, Himpens J, Shikora SA, Chevallier J-M, Lakdawala M, De Luca M, et al. The first consensus statement on one anastomosis/mini gastric bypass (OAGB/MGB) using a modified delphi approach. Obesity Surgery. 2018;**28**(2):303-312. DOI: 10.1007/s11695-017-3070-2

[61] Lutz TA, Bueter M. The physiology underlying Roux-en-Y gastric bypass: A status report. American Journal of Physiology—Regulatory, Integrative and Comparative. 2014;**307**(11):R1275-R1291. Epub 2014/09/26. DOI: 10.1152/ajpregu.00185.2014

[62] Spivak H, Abdelmelek MF, Beltran OR, Ng AW, Kitahama S. Long-term outcomes of laparoscopic adjustable gastric banding and laparoscopic Roux-en-Y gastric bypass in the United States. Surgical Endoscopy. 2012;**26**(7):1909-1919. DOI: 10.1007/s00464-011-2125-z

[63] Boyle M, Mahawar K. One anastomosis gastric bypass performed with a 150-cm biliopancreatic limb delivers weight loss outcomes similar to those with a 200-cm biliopancreatic limb at 18-24 months. Obesity Surgery. 2020 Apr;**5**(1):27-30

[64] Kalarchian MA, Marcus MD, Wilson GT, Labouvie EW, Brolin RE, LaMarca LB. Binge eating among gastric bypass patients at long-term follow-up. Obesity Surgery. 2002 Apr;**12**(2):270-275

[65] Dayyeh BK, Lautz DB, Thompson CC. Gastrojejunal stoma diameter predicts weight regain after Roux-en-Y gastric bypass. Clinical Gastroenterology and Hepatology. 2011 Mar 1;**9**(3):228-233

[66] Carrodeguas L, Szomstein S, Soto F, Whipple O, Simpfendorfer C, Gonzalvo JP, et al. Management of gastrogastric fistulas after divided Roux-en-Y gastric bypass surgery for morbid obesity: analysis of 1292 consecutive patients and review of literature. Surgery for Obesity and Related Diseases. 2005 Sep 1;**1**(5):467-474

[67] Heneghan HM, Yimcharoen P, Brethauer SA, Kroh M, Chand B. Influence of pouch and stoma size on weight loss after gastric bypass. Surgery for Obesity and Related Diseases. 2012 Jul 1;**8**(4):408-415

[68] Brethauer SA, Nfonsam V, Sherman V, Udomsawaengsup S, Schauer PR, Chand B. Endoscopy and upper gastrointestinal contrast studies are complementary in evaluation of weight regain after bariatric surgery. Surgery for Obesity and Related Diseases. 2006 Nov 1;**2**(6):643-648

[69] Abdeen G, Le Roux CW. Mechanism underlying the weight loss and complications of Roux-en-Y gastric bypass. Review. Obesity surgery. 2016 Feb;**26**(2):410-421

[70] Guimarães M, Osório C, Silva D, Almeida RF, Reis A, Cardoso S, et al. How Sustained is Roux-en-Y Gastric Bypass Long-term Efficacy?. Obesity Surgery. 2021 Aug;**31**(8):3623-3629

[71] Gorecki P, McClelland PH, Kabata K, Khusid E, Zenilman ME. Weight loss dynamics following laparoscopic Roux-en-Y gastric bypass. An analysis of 10-year follow-up data. Surgical Endoscopy. 2021 Sep;**35**(9):5315-5321

[72] Maciejewski ML, Arterburn DE, Van Scoyoc L, Smith VA, Yancy WS, Weidenbacher HJ, et al. Bariatric surgery and long-term durability of weight loss. JAMA surgery. 2016 Nov 1;**151**(11):1046-1055

[73] Cooper TC, Simmons EB, Webb K, Burns JL, Kushner RF. Trends in weight regain following Roux-en-Y gastric bypass (RYGB) bariatric surgery. Obesity Surgery. 2015;**25**(8):1474-1481. Epub 2015/01/18. DOI: 10.1007/s11695-014-1560-z

[74] Freire RH, Borges MC, Alvarez-Leite JI, Toulson Davisson Correia MI. Food quality, physical activity, and nutritional follow-up as determinant of weight regain after Roux-en-Y gastric bypass. Nutrition. 2012;**28**(1):53-58. Epub 2011/09/03. DOI: 10.1016/j.nut.2011.01.011

[75] van der Burgh Y, Boerboom A, de Boer H, Witteman B, Berends F, Hazebroek E. Weight loss and malnutrition after conversion of the primary Roux-en-Y gastric bypass to distal gastric bypass in patients with morbid obesity. Surgery for Obesity and Related Diseases. 2020 Mar 1;**16**(3):381-388

[76] Sugerman HJ, Kellum JM, DeMaria EJ. Conversion of proximal to distal gastric bypass for failed gastric bypass for superobesity. Journal of Gastrointestinal Surgery. 1997 Dec;**1**(6):5171-5178

[77] Shin RD, Goldberg MB, Shafran AS, Shikora SA, Majumdar MC, Shikora SA. Revision of Roux-en-Y gastric bypass with limb distalization for inadequate weight loss or weight regain. Obesity Surgery. 2019 Mar;**29**(3):811-818

[78] Ghiassi S, Higa K, Chang S, Ma P, Lloyd A, Boone K, et al. Conversion of standard Roux-en-Y gastric bypass to distal bypass for weight loss failure and metabolic syndrome: 3-year follow-up and evolution of technique to reduce nutritional complications. Surgery for Obesity and Related Diseases. 2018 May 1;**14**(5):554-561

[79] Wang A, Poliakin L, Sundaresan N, Vijayanagar V, Abdurakhmanov A, Thompson KJ, et al. The role of total alimentary limb length in Roux-en-Y gastric bypass–a systematic review. Surgery for Obesity and Related Diseases. 2021 Aug 30

[80] Amor IB, Petrucciani N, Kassir R, Malyshev E, Mazoyer C, Korkmaz C, et al. Midterm outcomes of gastric pouch resizing for weight regain after roux-en-Y

gastric bypass. Obesity Surgery. 2020 Jul;**30**(7):2723-2728

[81] León F, Maiz C, Daroch D, Quezada N, Gabrielli M, Muñoz C, et al. Laparoscopic hand-sewn revisional gastrojejunal plication for weight loss failure after Roux-en-Y gastric bypass. Obesity Surgery. 2015 Apr;**25**(4):744-749

[82] Siilin H, Wanders A, Gustavsson S, Sundbom M. The proximal gastric pouch invariably contains acid-producing parietal cells in Roux-en-Y gastric bypass. Obesity surgery. 2005 Jun;**15**(6):771-777

[83] Dapri G, Cadière GB, Himpens J. Laparoscopic placement of non-adjustable silicone ring for weight regain after Roux-en-Y gastric bypass. Obesity surgery. 2009 May;**19**(5):650-654

[84] Bessler M, Daud A, DiGiorgi MF, Inabnet WB, Schrope B, Olivero-Rivera L, et al. Adjustable gastric banding as revisional bariatric procedure after failed gastric bypass—intermediate results. Surgery for Obesity and Related Diseases. 2010 Jan 1;**6**(1):31-35

[85] Jirapinyo P, Slattery J, Ryan MB, Dayyeh BA, Lautz DB, Thompson CC. Evaluation of an endoscopic suturing device for transoral outlet reduction in patients with weight regain following Roux-en-Y gastric bypass. Endoscopy. 2013 Jul;**45**(07):532-536

[86] Gallo AS, DuCoin CG, Berducci MA, Nino DF, Almadani M, Sandler BJ, Horgan S, Jacobsen GR. Endoscopic revision of gastric bypass: Holy Grail or Epic fail?. Surgical endoscopy. 2016 Sep;**30**(9):3922-3927

[87] Kim HJ, Madan A, Fenton-Lee D. Does patient compliance with follow-up influence weight loss after gastric bypass surgery? A systematic review and meta-analysis. Obesity surgery. 2014 Apr;**24**(4):647-651

[88] Conceição E, Pinto-Bastos A, de Lourdes M, Brandão I, Teixeira C, Machado PPP. Psychological, behavioral, and weight-related aspects of patients undergoing reoperative bariatric surgery after gastric band: Comparison with primary surgery patients. Surgery for Obesity and Related Diseases. 2018;**14**(5):603-610. DOI: 10.1016/j.soard.2018.02.011