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SAGES/ASBS REOPERATIVE BARIATRIC SURGERY PANEL

Reoperative bariatric surgery

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As in cardiac and vascular surgery, reoperations or revisions of previous failed or complicated bariatric operations have become necessary in many different situations. In this regard, nearly all general surgeons need to be at least conversant in some of these complications. Though complications of the old jejunoileal bypass are now encountered only rarely, revision of failed, previous open gastroplasties remains a common problem today, and we are now entering a new era of failed or complicated laparoscopic bariatric procedures [primarily Roux-en-Y gastric bypass (RYGB), LAP-BAND] that present different variations of problems encountered after open bariatric surgery (stomal ulcers and stenosis, gastrogastric fistulas, etc.) as well as new problems (internal hernias, antiperistaltic limbs, etc.). This short piece reviews reoperative bariatric surgery primarily after prior open procedures and will use the types of complications encountered in the past to address reoperative bariatric surgery in the laparoscopic era over the last six years.

The type of failures and complications of bariatric surgery in the prelaparoscopic era (1960s to 2000) differed from the current laparoscopic era for several reasons: first, due to the different and ultimately less-effective operations, such as the small-intestinal bypass, the multitude of gastric staplings, and early experience with (horizontal, non-disconnected) gastric bypass; second, open surgery led to more-local adhesions, thereby minimizing such complications as internal hernias or intussusceptions (see below); and third, the open approach maximized classic exposure and was more familiar to the average, non-laparoscopic-trained surgeon.

Overall, reoperative or revisionary bariatric surgery was (and still is) directed at three problems: ineffective weight loss, non-life-threatening side-effects of the operation affecting quality of life, and serious complications affecting health [1].

Ineffective Weight Loss

The prelaparoscopic era was the developmental stage of bariatric surgery. Multiple, theoretically attractive (at least ostensibly) anatomic configurations were evaluated, many with unsatisfactory or even serious outcomes, such as small-bowel bypasses (Table 1). Currently, most reoperative bariatric procedures for ineffective weight loss involve patients who have undergone one of the multiple types of gastroplasty (stomach staplings). When evaluating these patients, both some form of imaging procedure and a careful review of the previous operative notes are imperative. Imaging by upper radiologic gastrointestinal contrast examination or preferably upper endoscopy will allow the recognition of several important findings: the presence or absence of a staple-line breakdown with a gastrogastric fistula (with loss of the restrictive component), the diameter of the stoma, and the size of the proximal pouch (to determine whether a functional pouch with maintenance of a restrictive effect still

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Table 1 Most-common bariatric operations

Prelaparoscopic era
Jejunoileal bypasses
End-to-end
End-to-side
Gastroplasties
Horizontal versus vertical
Banded/ring versus nonbanded
Gastric bypass
Loop horizontal gastric bypass
Roux-en-Y gastric bypass
Mini gastric bypass
Malabsorptive procedures
Biliopancreatic diversion (Scopinaro procedure)
Distal gastric bypass
Duodenal switch/biliopancreatic diversion
Laparoscopic era
Gastric bypass
Roux-en-Y
Mini-gastric bypass (loop)
LAP-BAND
Duodenal switch with biliopancreatic diversion

exists). Review of the operative notes should define whether the stoma is along the lesser or greater curvature or somewhere within the partitioning staple line, whether the staple line was horizontal or vertical, and whether the stoma was banded (vertical banded/ring gastroplasty). Patients, however well meaning and ostensibly well informed, and any notes from physicians and even non-bariatric surgeons, are simply not reliable; the terms often used are not accurate and are inappropriate (e.g., stomach stapling, stomach bypass, intestinal bypass, etc.). In addition, many of the older horizontal gastroplasties involved full mobilization of the greater curvature of the stomach with ligation of all the left gastroepiploic and short gastric blood supply to the greater curvature, which might prove pertinent if staple lines cross. The best approach to any reoperative situation is to try to avoid surprises and to read all previous operative notes carefully before operation.

Previous gastroplasty

The most common reoperative approach for ineffective weight loss after a previous gastroplasty is to convert the anatomy to that of a RYGB and not to simply restaple a disrupted staple line or to try to reestablish a gastroplasty anatomy; results with such an approach are inevitably poor [2]. Usually the patient has adapted to the anatomy or has changed their diet to high-calorie sweets, which defeats any purely restrictive bariatric procedure, possibly even a laparoscopic gastric band, although solid evidence one way or the other is lacking.

A few technical tips are offered. It is usually easy to get proximal to the previous partitioning staple line; indeed, the proximal pouch is usually quite large. When developing the retrogastric tunnel, start at the left esophagogastric junction; there is no need to mobilize any of the greater curvature. I would suggest completely dividing the proximal pouch from the to-be-bypassed stomach, rather than using multiple applications of the stapler to maintain the partition, especially if the previous staple line failed. Second, be absolutely certain that the now most-proximal aspect of the bypassed stomach (distal to your new staple line but proximal to the old staple line) drains into the distal stomach; it is best to pass a large-bore orogastric tube into the distal stomach through the previous stoma or staple-line breakdown to assure adequate drainage before transecting the stomach proximally. If there is any doubt, do a simple, short gastrogastrostomy between these pouches in the now bypassed stomach. If the patient has had any form of banded stoma, remove the band; should it erode into the bypassed stomach, you would no longer have easy endoscopic access. Finally, strongly consider some form of tube enterostomy. I prefer a gastrostomy in the bypassed stomach; because this is a reoperation, the risk of anastomotic leak is greater, and a gastrostomy both assures decompression of the distal stomach and a potential route for enteral feeding. A needle catheter jejunostomy is another option [3].

Previous gastric bypass

Do not be fooled—remember that the original "gastric bypass" was a loop gastrojejunostomy after a horizontal gastric partition. Also, one of the original gastroplasties involving a complete horizontal gastric partitioning with a gastrogastric stoma was also called a "gastric bypass".

Causes of ineffective weight loss after a previous RYGB are usually twofold—either breakdown of a nondivided gastric partition or the development of a gastrogastric fistula between a divided partition (often after an anastomotic leak), or intestinal adaptation to an intact RYGB anatomy with tolerance of large meals. With the former (a functional gastrogastric fistula of either type), be certain to exclude a stomal stricture at the gastrojejunostomy, especially if the proximal pouch is large (greater than 100 mL)—which it almost always is. My approach in these situations is to downsize markedly the proximal pouch by stapling proximal to the previous staple line and redoing the gastrojejunostomy to a cardiojejunostomy. If the Roux limb is short, i.e., less than 75 cm, I usually relocate the site of the jejunojejunostomy such that the Roux limb is 150 cm

long; some thought should be given to converting to a malabsorptive-type gastric bypass [4].

A difficult dilemma concerns the patient with an anatomically intact, non-malabsorptive RYGB. The classic revisionary procedure is to convert them to a malabsorptive distal gastric bypass by diverting the pancreatobiliary secretions to the distal ileum (50–100 cm proximal to the ileocecal juncture) by taking down the original jejunojejunostomy and constructing a jejunoileostomy [4]; good results with this approach are not common.

Results

The results of reoperative bariatric surgery for ineffective weight loss are not as good as for primary bariatric procedures [1, 2]. In our experience, the eventual body-mass indexes (BMIs) reached after at least one year postoperatively are 35–37 kg/m^2 and not as good as primary RYGB (BMIs: 30–32 kg/m^2).

Complications of Previous Bariatric Procedures

Complications specific to prior bariatric procedures that may require revisionary surgery are outlined in Table 2.

Table 2 Overview of complications of bariatric surgery

Stomal problems*
Stenosis
Ulcer/bleeding
Dysfunctional emptying
Staple-line disruption†
Dehiscence, loss of gastric partition
Gastrogastric fistula
Biliopancreatic limb obstruction*
Pancreatitis
Obstructive jaundice
Internal hernia*
Transverse mesocolon
Jejunojejunostomy
Peterson's hernia
Trocar sites
Abnormalities of Roux limb
Functionally too short (reflux)
Antiperistaltic Roux (reflux)
Intussusception (jejunogastric, jejunojejunal)
Obstruction at mesocolic window
Problems with LAP-BAND
Slippage, obstruction
Erosion

† After gastroplasty, RYGB

* After RYGB, BPD, DS/BD

While symptoms may appear similar, many complications are specific to the type of bariatric operation (Table 3) and, therefore, careful review of the prior operative note is imperative to try and avoid surprises in the operating room. Talking with the surgeon who performed the previous bariatric procedure may shed considerable light on the situation, especially if the operative notes are confusing. Moreover, upper-gastrointestinal (GI) endoscopy is almost always necessary, while upper-GI contrast radiography can be complementary in selected situations.

Gastroplasty

The most serious complications are related to the stoma, usually stenosis. Patients present with vomiting of undigested food and reflux but no pain and can lose considerable weight with serious nutritional compromise. Banded stomas may have the band/ring erode, causing bleeding, pain, and/or stenosis. A potentially serious problem is stomal dysfunction (stenosis or non-mechanical obstruction) with gastroesophageal reflux disease (GERD), development of Barrett's esophagus, recurrent aspiration pneumonia, or reflux-induced asthma.

RYGB

Most problems occur either at the stomach or distally in the Roux limb/jejunojejunostomy. Stomal problems include stenosis (more common after a laparoscopic versus an open RYGB—5 versus 1%) with vomiting. Stenosis can occur secondary to stomal ulcer, which can also cause bleeding and/or pain. Look for a gastrogastric fistula/connection, surreptitious nonsteroidal anti-inflammatory drug (NSAID) use, or too large a proximal pouch. Intestinal obstructions can occur from internal hernias/obstructions where the Roux limb passes through the mesocolon, at the enteroenterostomy, or infracolically behind the Roux limb mesentery (Peterson's hernia) [5]. A specific obstruction that can present as nonproductive postprandial vomiting/retching and epigastric bloating/pain is obstruction of the pancreatobiliary limb with dilation of the bypassed stomach and duodenum (rarely this will be an intussusception). Finally, especially with inexperienced surgeons, mismeasurements can occur, with the creation of an antiperistaltic Roux limb [6], or too short a Roux limb (less than 70 cm) causing persistent biliary vomiting (which should *never* occur after RYGB) or an inadvertent jejunoileostomy causing diarrhea and steatorrhea secondary to maldigestion/malabsorption. With diarrhea, be certain to exclude bacterial overgrowth.

Table 3 Serious surgical complications to bariatric procedures

Gastroplasty	RYGB (open)	LAP-BAND	RYGB (lap)	DS/BD
Stomal stenosis	Stomal stenosis	Obstruction	Stomal stenosis	Stomal stenosis
Stomal erosion by band/ring	Stomal ulcer*	Band erosion	Stomal ulcer	Stomal ulcer*
Dehiscence of staple-line partition	Gastrogastric fistula	GERD	Gastrogastric fistula	Stricture gastric tube
GERD			Incomplete gastric partition	
	Intestinal obstruction		Intestinal obstruction	Intestinal obstruction
	• Pancreatobiliary limb†		• Pancreatobiliary limb	• Pancreatobiliary limb†
	• Roux limb at mesocolon		• Trocar site	• Roux limb at mesocolon
	• Superior mesenteric artery (SMA) syndrome		• Intussusception	
			• SMA syndrome	
	Internal hernia (rare)		Internal hernia	Internal hernia
			• Mesenteric	
			• Peterson's hernia	
			• Mesocolic	
			Antiperistaltic Roux limb	Malabsorption
				• Too short a common channel**
			Mismeasured Roux limb	
			• Roux too short	
			• Inadvertent jejunoileostomy**	

* Pain, bleeding; † Pancreatitis, jaundice; ** Steatorrhea

Duodenal switch (DS)/biliopancreatic diversion (BD)

Many complications mimic those of RYGB, including stomal problems, internal hernia, and intestinal obstructions. Specific problems can also involve stenosis of the lesser-curvature gastric tube (presenting similar to stomal stenosis) and steatorrhea from the common channel being anatomically (less than 75 cm) or functionally too short (100 cm) for that patient.

Gastric banding

Serious complications of gastric banding involve almost exclusively the band causing either obstruction from slippage or erosion with obstruction, bleeding, or rarely perforation.

Problems Unique to Laparoscopic Procedures

The early introduction of minimal-access approaches led to a relatively new spectrum of complications. Obstructions at trocar sites can be difficult to diagnose in obese patients. Internal hernias are much more common (mesocolic, mesenteric at the jejunojejunostomy, Peterson's hernia) because of less-local adhesions and warrant clinical suspicion and aggressive operative treatment. Creation of the proximal gastric pouch laparoscopically has led inexperienced surgeons to create larger-volume, lesser-curvature-based pouches, retaining a surprisingly large amount of fundus posteriorly (the cardiac fat pad should be mobilized to see the angle of His) or to overlook incomplete gastric partitioning with maintenance of a gastrogastric connection at the greater curvature. Finally, the minimal-access approach can inhibit classic landmarks, leading to mismeasurement, misidentification of structures with the creation of too short or too long a Roux limb, or more seriously the creation of an antiperistaltic Roux limb by misidentifying the distal end of the pancreatobiliary limb as the proximal end of the common channel.

Conclusions

Reoperative bariatric surgery requires a complete preoperative workup and operative plan. While all abdominal surgeons require basic knowledge of postbariatric surgical complications and emergencies, pseudoelective and elective revisions should be done by experienced bariatric surgeons.

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