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REVIEW ARTICLE

Operative Treatments for Reflux After Bariatric Surgery: Current and Emerging Management Options

Daniela Treitl[1] · **Derek Nieber**[1] · **Kfir Ben-David**[1]

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Abstract Gastroesophageal reflux disease (GERD) is a common disorder that has a well-established connection with obesity. To ameliorate the morbidity associated with obesity, bariatric procedures have become an established pathway to accomplish sustained weight loss. In some procedures, such as with the Roux-en-Y gastric bypass surgery, weight loss is also accompanied by the resolution of GERD symptoms. However, other popular bariatric surgeries, such as the sleeve gastrectomy, have a controversial impact on their effect on reflux. Consequently, increased attention has been given to the development of strategies for the management of de novo or recurrent reflux after bariatric surgery. This article aims to discuss medical and surgical strategies for reflux after bariatric surgery, and their outcomes.

Keywords Gastroesophageal reflux disease · Bariatric surgery · Obesity

Epidemiology of GERD

Gastroesophageal reflux disease (GERD), defined by the presence of at least weekly sensation of heartburn or acid regurgitation or, per the Montreal criteria, as a condition that "causes troublesome symptoms and/or complications" due to the reflux of stomach contents, comprises a variety of symptoms.[1] In addition to heartburn and regurgitation, symptoms include dysphagia, chest pain and globus sensation, cough, hoarseness, aspiration, and shortness of breath.[2] In addition, patients who experience GERD can manifest signs of mucosal inflammation on endoscopy, known as erosive esophagitis, or lack signs of mucosal damage, known as non-erosive reflux disease. Untreated GERD patients can experience increased frequency in esophagitis and have an increased risk for developing Barrett's esophagus, ultimately placing patients at higher risk for developing esophageal adenocarcinoma.[2] Current evidence suggests that the prevalence of GERD has increased since 1995 and establishes that obesity, tobacco, and heredity are the main risk factors.[1] Interestingly, the prevalence of GERD varies worldwide, ranging up to 18–27% in North America compared to as low as 2.5–7.8% in East Asia.[1] Once considered a Western disease, GERD prevalence has been increasing in Asia in the last 10–20 years, likely due to environmental factors associated with lifestyle changes and rising rates of obesity in the region.[3]

GERD and Obesity

It is apparent that overweight patients are at an increased risk of GERD symptoms, at a rate of 1.2–3 times higher than non-overweight. In fact, the prevalence of reflux symptoms and the DeMeester score increase in a dose-dependent relationship with body mass index (BMI). This is reflected by the presence of GERD in up to 50% of patients whose BMI is greater than 30 kg/m^2, and by the fact that an increase of 5 kg/m^2 in the BMI leads to a three-point increase in DeMeester Score.[4–6] The link between obesity and GERD is thought to be multifactorial and related to (1) increased trans-diaphragmatic pressure gradients that favors reflux; (2) increased incidence of hiatal hernia and widening of the angle of His which impairs

✉ Kfir Ben-David
Kfir.bendavid@gmail.com

[1] Comprehensive Cancer Center, Mount Sinai Medical Center, 4306 Alton Road, 2nd Floor, Miami Beach, FL 33140, USA

the lower esophageal sphincter (LES); (3) increased episodes of transient lower esophageal sphincter relaxations (TLESR), possibly related to elevated levels of estrogen and/or presence of hiatal hernia; and (4) impaired esophageal clearance secondary to hyposalivation and altered motility.[4,7,8] Regardless of contributory factors, obesity and GERD are interrelated, and as obesity rates have increased worldwide, so have the number of weight loss procedures being performed, and new studies attempting to establish the effects of bariatric surgery on GERD.

GERD Following Bariatric Surgery

GERD symptoms typically improve following Roux-en-Y gastric bypass surgery. However, data shows conflicting effects, and often worsening of symptoms, following other types of bariatric operations.

Roux-En-Y Gastric Bypass

Current evidence indicates that there is a clear reduction in GERD symptoms or resolution of GERD in the majority of post Roux-en-Y gastric bypass (RYGB) surgery patients.[9–13] One study of 55 patients with preoperative GERD reported that 96% of their patients showed improvement or resolution of symptoms following RYGB.[12] In addition, esophageal acid exposure, esophagitis, and DeMeester score have all shown to be significantly decreased in studies up to 39 months following RYGB.[11,13] The antireflux effect of RYGB is thought to come from diverting bile from the stomach, promoting weight loss, lowering acid production in the gastric pouch by decreasing the population of parietal cells, accelerated gastric emptying, and decreasing abdominal pressure over the LES.[4,7] In patients with pre-existing GERD symptoms, the RYGB could treat both obesity and GERD symptoms.

Laparoscopic Adjustable Gastric Banding

Unlike RYGB, the evidence for a reduction in GERD symptoms after laparoscopic adjustable gastric banding (LAGB) is conflicting. Several studies show short-term improvement in symptoms and medication usage after LAGB, with 76–80% of patients experiencing resolution of pre-existing GERD symptoms for up to 2 years post LAGB.[14,15] Additional reports have shown the resolution of esophageal lesions at 1 year follow up[16] and a reduction in the postoperative DeMeester score.[17] While these data suggest that a correctly placed gastric band can relieve GERD,[17] thought to be related to weight loss, augmentation of the LES by direct mechanical effects of the band, and prevention of hiatal hernia,[7] other data have presented contradictory findings. In fact, some studies have shown late development of GERD post LAGB, with 20.5% of patients developing de novo GERD at 3 years post-op,[18] and high prevalence of esophagitis (30%) and pathologic reflux (43.8%) on endoscopy and pH-metry at 3 to 4 years postoperatively.[19] Possible reasons for worsened reflux in these cases are related to reduced esophageal clearance, pouch formation, food stasis, and reversible esophageal dilatation.[7,20–22] More studies are needed to uncover the potential discrepancies between early and late effects of LAGB on reflux but not likely to occur since this bariatric procedure has fallen out favor for surgeons and patients.

Sleeve Gastrectomy

Bariatric surgery trends have changed in the recent years, with a decrease in both LAGB and RYGB, while the amount of sleeve gastrectomy (SG) cases continue to rise, now becoming the most commonly performed bariatric surgery.[23] With the rapid increase in SG procedures being performed, and the prevalence of GERD, several studies have looked at postoperative outcomes with regards to reflux. As in the case of LAGB, evidence has also been controversial for postoperative GERD in SG cases, with most studies reporting an increase in GERD symptoms.[18,24–28] By symptom criteria, 8.6–47% of patients reports GERD symptoms postoperatively.[24,29,30] In a retrospective review of the Bariatric Outcomes Longitudinal Database, 44.5% of LSG patients and 50.4% of bypass patients had pre-existing GERD with 15.9 and 62.8% resolution after surgery, respectively.[29]

Tai et. al examined symptoms of GERD and erosive esophagitis at 1 year following LSG and concluded there was a significant increase in the prevalence of GERD, erosive esophagitis, and hiatal hernia.[24] The mechanism behind these findings is thought to be related to widening of the angle of His, decreased LES pressure secondary to resection of sling fibers, and increased intragastric pressure due to decreased gastric compliance.[4,31,32] In patients undergoing esophageal manometry after SG, 85% of patient had LES incompetence after surgery, despite normal pressures preoperatively, and most patients also had shortening of high pressure zone at the esophagastric junction.[31] Other factors leading to the increased incidence of GERD after SG include the formation of a proximal "neofundus" and the development or missing of a hiatal hernia.[4,7,24,28,33] Improvement in GERD symptoms theoretically can be due to reduced population of parietal cells and enhanced gastric emptying.[34] Several studies have shown a positive impact of SG on GERD in patients with pre-existing symptoms.[35] A meta-analysis of the current available evidence reported heterogeneity of the studies, but concluded that there is a trend toward increased prevalence of GERD after SG.[36]

Patients with hiatal hernias pose a technical challenge in the case of SG, as repair that is too tight can lead to dysphagia and stenosis. Although one study showed no improvement in symptoms, several other studies report improvement of GERD when hiatal hernia repair is undertaken.[35] In another study, patients were diagnosed with hiatal hernias preoperatively and even more diagnosed intraoperatively, and repair in addition to SG was shown to be effective in improving GERD symptoms with remission in 73.3% of patients. None of the patients that had a hiatal hernia repair developed de novo GERD, while 22.9% of patients who only had SG developed de novo GERD.[37] Another study has shown contradictory findings, with hiatal hernia repair improving symptoms in a third of patients and de novo GERD occurring in 15.6% of asymptomatic patients.[38]

Intragastric Balloon

Intragastric balloon (IGB) has been shown to be an effective procedure for short-term weight loss; however, it is associated with development of gastric ulcers in 0.3% of patients and GERD in 14.3%.[39] In one study, although no gastric or esophageal ulcers were observed and patients were discharged on proton pump inhibitor (PPI) therapy, over half of the patients developed symptoms of GERD which were controlled with increase dosage of PPI.[40] In a study measuring 24 h pH before and after intragastric balloon treatment, increased acid exposure was seen in patients in the treatment arm, and the same parameters were improved after removal.[41] However, the positioning of the gastric balloon seems to have an effect on reflux, with higher incidence of GERD found in patients with IGB placed in the fundus as opposed to the antrum.[42]

De-Novo GERD After Bariatric Surgery

De novo GERD after SG occurs in 0 to 34.9% of patients with a pooled incidence of 20%.[29,36,43] This is very concerning, and has led to seeking of alternative solutions. Due to the growing controversies over the association of SG and GERD, some groups have begun to alter surgical practices, adding antireflux procedures as a preventative measure. In a study by Santoro et. al, adding the antireflux procedure of hiatoplasty and 180° cardioplication showed improvement in the majority of the patients with pre-existing GERD, with resolution in 61.4%.[44] Another group performed the Nissen-sleeve gastrectomy: a sleeve gastrectomy with a concomitant Nissen fundoplication on patients with esophageal syndromes.[45] Most patients were asymptomatic at 3 and 6 month follow up, with 3 out of 25 patients who remained symptomatic.[45]

Medical and Endoscopic Management

When patients experience reflux after a bariatric procedure, first line therapy is like that of the general population, with dietary modifications and cessation of smoking and alcohol use. Second line therapy is using acid-reducing medications. The use of acid-reducing medications has been shown to decrease from 37.7 to 29.6% at 1 year after bariatric procedures, but it was not uniform among the different operations, with 56.2% of patients who were previously on PPI or H2-blocker discontinue these medications if the procedure is RYGB.[46] In another study showing similar results, more patients after SG used acid-reducing medications as compared to RYGB (48.1 vs. 16.1%)[47]. In the four studies included in a recent meta-analysis, the antireflux medication use after SG increased in two studies and decreased in one, and was unchanged in the fourth study.[36] While in some patients with GERD after bariatric surgery antireflux medications are sufficient to control symptoms, other patients experience symptoms despite maximal medical therapy, and more invasive therapy is considered.

One such technique is the Stretta procedure, an endoscopic approach used in the treatment of GERD which delivers radiofrequency energy to the LES. A 10-year outcome study has shown sustained improvement in GERD symptoms in 72% of patients following the procedure.[48] This procedure was used in patients after RYGB for refractory GERD, with 83% of patients having resolution of symptoms and no further need for medications.[49] Although other approaches to fundoplication using endoscopic techniques have been developed in the management of GERD for the general population, to our knowledge, data has not been published for patients after bariatric procedures. In addition, these procedures would only be applicable in the select cases where there is residual fundus.

Conversion to Roux

After failure of medical treatment, the standard treatment for intractable GERD despite maximal medical therapy after a SG is conversion to RYGB, with weight-loss failure acting as an additional indication for sleeve gastrectomy conversion to RYGB. The choice of procedure is important in the context of GERD. When revisional surgery occurs in sleeve gastrectomy for the purposes of weight loss failure, and the procedure chosen is duodenal switch, de novo GERD can develop in as much as 26% of patients.[28] In a series of 34 patients with weight loss failure or refractory GERD after SG, conversion to RYGB was undertaken. Most patients (94%) underwent laparoscopic surgery, but high morbidities occurred with four patients (11.7%) developing major adverse events. Most patients underwent revisional surgery due to weight loss failure.

In the intractable GERD group, all three patients resolved their reflux symptoms after revision with cessation of PPI medications.[50] Multiple other groups have reported their results of conversion to RYGB from SG, showing similar results with complete resolution of GERD.[51] Although this remains the standard approach, alternative surgical methods have been studied in attempt to decrease the morbidities associated with redo surgery.

Alternative Surgical Approaches

Due to the anatomic removal of the fundus with SG and RYGB, refractory GERD after these procedures creates a surgical dilemma with limited options. Alternative surgical treatment for patients with previous SG has included redo SG, considered especially when residual fundus or pouch dilatation has been the causal factor for GERD symptoms. Small series of patients treated with redo SG had remission of reflux symptoms in the short term[52,53].

Another proposed surgical approach for reflux after SG is cardiopexy with ligamentum teres and hiatal hernia repair. In a small case series, good results were seen at 3 and 6 months, and 1 year, with 86.6% of patients having resolution of symptoms and cessation of medications, while two patients continued to experience reflux.[54] Likewise, in the case of RYGB, revision of the RYGB for patients with recurrent reflux has been advocated especially when a short alimentary limb leads to bile reflux or when too much gastric pouch has been left behind, as this contains acid-producing parietal cells.[55]

A newly developed approach to reflux, the magnetic sphincter augmentation device, has been used in patients with mild GERD with good results and long-term safety having been established.[56,57] In a small retrospective series, the safety and feasibility of using this device off label for refractory GERD after SG was shown.[58] This presents as a viable alternative, with the potential for fewer surgical complications incurred, many of which are inherent to redo surgery, likely due to the device being implanted in an area not disturbed by the prior surgery. In this series, all patients had improvement of GERD symptoms.[58] Likewise, this device, in concurrence with a hiatal hernia repair, has been used in one case after RYGB for severe refractory reflux with excellent patient satisfaction.[59] This device offers another option to a difficult problem that is sure to continue to be on the rise.

Conclusions

GERD after bariatric surgery is a complex problem if medical management fails. First line of therapy is the use of antireflux medications. More invasive approaches include endoscopic radiofrequency therapy, which have been used in a small group of patients with refractory GERD after RYGB. The typical approach for refractory GERD after bariatric surgery is conversion of SG to RYGB. Redo surgery can be undertaken, and a new alternative approach is implantation of a magnetic sphincter device, which has shown good results in small series.

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