

# Gastroesophageal Reflux Disease After Bariatric Procedures



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## KEYWORDS

• GERD • Roux-en-Y gastric bypass • Sleeve gastrectomy

## KEY POINTS

- There is a clear relationship between gastroesophageal reflux disease (GERD) and obesity.
- Roux-en-Y gastric bypass (RYGB) is associated with decreased incidence of GERD and is the procedure of choice for obese patients with GERD seeking a bariatric procedure.
- The information regarding GERD after adjustable gastric banding (AGB) and sleeve gastrectomy (SG) is contradictory, thus surgeons should avoid these procedures for patients with GERD seeking weight loss surgery.
- In case of de novo GERD after AGB or SG, in severe cases, conversion to RYGB is safe and effective.

## INTRODUCTION

Obesity has reached epidemic proportions in the United States and around the world. Recent reports show that up to 35% of adults in the United States are considered obese.<sup>1</sup> With the number of obese individuals increasing, there is an exponential increase in the number of weight loss surgeries being performed. As we are gaining knowledge about the different comorbidities and complications after weight loss surgery, gastroesophageal reflux disease (GERD) remains an important and controversial topic among bariatric surgeons. This article reviews the current knowledge of GERD after bariatric surgery.

## GASTROESOPHAGEAL REFLUX DISEASE

GERD refers to symptoms or pathologic findings produced by stomach contents flowing backward into the esophagus or beyond.<sup>2</sup> It is one of the most commonly encountered gastrointestinal diagnoses for gastroenterologists and primary care doctors. A systematic review cited a prevalence of GERD between 10% and 20% of the

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### Abbreviations

AGB	Adjustable gastric banding
GERD	Gastroesophageal reflux disease
LAGB	Laparoscopic adjustable gastric banding
LES	Lower esophageal sphincter
LSG	Laparoscopic sleeve gastrectomy
RYGB	Roux-en-Y gastric bypass
SG	Sleeve gastrectomy

Western population to have weekly symptoms of GERD,<sup>3</sup> and others have cited between 60 and 70 million Americans as being affected annually.<sup>4</sup> It has significant impact on quality of life and health care costs.<sup>5,6</sup> The pathogenic pathway commonly described is owing to lower esophageal sphincter (LES) dysfunction, which prevents the LES from contracting and allows reflux of gastric contents into the esophagus.

### GASTROESOPHAGEAL REFLUX DISEASE AND OBESITY

More than one-third of the adult population in the United States is now considered obese.<sup>7</sup> The association between GERD and obesity has generated great interest, because obesity has been indicated as a potential risk factor for reflux disease.<sup>8</sup> A directly dependent relationship has been reported because an increase in body mass index has mirrored an increase in the risk of GERD.<sup>9</sup> The incidence of reflux in the obese population has been cited as high as 61%.<sup>10</sup> The pathophysiologic mechanism underlying the link between obesity and GERD has not been fully elucidated and seems to be multifaceted. As the number of obese patients is increasing, so is the volume and variety of bariatric procedures. The effect of bariatric surgery on preexisting GERD or newly developed GERD differs by procedure.

### GASTROESOPHAGEAL REFLUX DISEASE AFTER ROUX-EN-Y GASTRIC BYPASS

Roux-en-Y gastric bypass (RYGB) has been used as a standalone reflux procedure. Mechanisms of the antireflux effect of RYGB include diverting bile from the Roux limb, promoting weight loss, lowering acid production in the gastric pouch, rapid pouch emptying, and decreasing abdominal pressure over the LES. Several studies have examined the relationship between GERD and RYGB.<sup>11</sup> Studies have also analyzed symptomatic relief by using questionnaires before and after the procedure.<sup>12–15</sup> These studies have shown improvement in symptoms after surgery. Others have also shown symptomatic improvement when using 24-hour pH-metry<sup>15,16</sup> and manometric studies.<sup>16</sup> One study has examined further the incidence of esophagitis postoperatively on endoscopy.<sup>16</sup> Merrouche and colleagues<sup>16</sup> showed a 6% incidence of esophagitis on endoscopy after RYGB; however, the preoperative incidence was not mentioned.

Pallati and colleagues<sup>17</sup> also examined the GERD symptoms after several bariatric procedures by using the Bariatric Outcomes Longitudinal Database. GERD score improvement was highest in the RYGB group; 56.5% of patients showed improvement of symptoms. The study concluded that RYGB was superior to all other procedures in improving GERD. The proposed but unproven mechanisms included a greater weight loss and a decrease in the amount of gastric juice in the proximal pouch.<sup>17</sup> The study, however, did not show any objective measures of GERD improvement.

Another study by Frezza and colleagues<sup>18</sup> showed a significant decrease in GERD-related symptoms over the 3-year study after laparoscopic RYGB, with

decrease in reported heartburn from 87% to 22% ( $P < .001$ ). The authors proposed that, in addition to volume reduction and rapid egress, the mechanism of how this procedure affects symptoms of GERD is through weight loss and elimination of acid production in the gastric pouch. The gastric pouch lacks parietal cells; thus, there is minimal to no acid production and also, owing to its small size, it minimizes any reservoir capacity to promote regurgitation.

Varban and colleagues<sup>19</sup> examined the utilization of acid-reducing medications (proton pump inhibitor and H<sub>2</sub>-blockers) at 1 year after various bariatric procedures. The groups reported that at 1 year after RYGB, 56.2% of patients would discontinue an acid-reducing medication that they had been using at baseline. Interestingly, the group also showed that 19.2% of patients would also start a new acid-reducing medication after RYGB.

Given the number of studies that have reported improvement in GERD symptoms after RYGB, this procedure is now widely accepted as the procedure of choice for treatment of GERD in the morbidly obese patient.<sup>18,20</sup> Although no increased risk is conferred to patients with a body mass index of 35 kg/m<sup>2</sup> or higher who undergo fundoplication for GERD,<sup>21,22</sup> the recommendation and practice of many surgeons is to perform a laparoscopic gastric bypass in lieu of fundoplication owing to its favorable effect on other comorbid conditions. In addition, advocates of the RYGB are promoting a conversion to an RYGB instead of a redo fundoplication.<sup>22–24</sup> In a recent study, Stefanidis and colleagues<sup>25</sup> followed 25 patients who had previous failed fundoplication, which was taken down and converted to an RYGB. Patients were followed with the Gastrointestinal Quality of Life Index and the Gastrointestinal Symptoms Rating Sale. The revision surgery led to resolution of GERD symptoms for a majority of the patients. The authors concluded that an RYGB after a failed fundoplication has excellent symptomatic control of symptoms and excellent quality of life.<sup>25</sup> However, owing to the technical challenges of the procedure and the potential for high morbidity, it should only be performed by experienced surgeons.

## GASTROESOPHAGEAL REFLUX DISEASE AFTER ADJUSTABLE GASTRIC BAND

The adjustable gastric band became a popular procedure owing to its simplicity and perceived safety profile. The association between the band and GERD is conflicting. The majority of studies show that symptoms and pH improve after gastric band placement, although some suggest an increase in GERD after placement.

A recent review by Ardila-Hani and Soffer<sup>26</sup> reviewed the effect of the 3 common bariatric procedures on gastrointestinal motility. The authors reported that the LAGB was associated with esophageal motor dysfunction and esophageal dilation. Several mechanisms may play a role, such as esophageal outflow obstruction or dysmotility from higher pressure. Animal studies have showed that placement of a nonobstructive band around the esophagogastric junction results in dilation proximal to the band<sup>27</sup> and an increase in resting LES pressure and frequency of aperistalsis.<sup>28</sup> O'Rourke and colleagues<sup>28</sup> further showed that, when the band is placed at the esophagogastric junction, symptoms developed sooner compared with when placed around the proximal stomach. However, both placements resulted in esophageal motility disorder or abnormal peristaltic sequences. Tolonen and colleagues<sup>29</sup> showed that reflux episodes significantly decreased postoperatively in patients analyzed with 24-hour pH monitor. The group concluded that a gastric band that is correctly placed and adjusted leads to relief of GERD symptoms.

Other studies have showed esophageal dilation on radiographic studies after band placement, which is explained by the band causing an outflow obstruction.<sup>30–34</sup>

Although this finding is significant, it may not translate into symptomatic findings.<sup>32</sup> In addition, dilation can be reversed after emptying of band.<sup>30,33</sup> Thus, an overly tightened band can induce reflux. Even if asymptomatic, patients with ABG will need follow-up for appropriate band adjustments.

Studies have examined symptomatic relief and decreased use of medication after LAGB.<sup>17,19,30,35–39</sup> Most of these studies have shown a decrease in symptoms and use of medication; however, 1 study has shown an increase in heartburn.<sup>36</sup> A systematic review cited newly developed symptoms after LAGB between 6% and 50%.<sup>40</sup> Although relief of symptoms can be explained by weight loss in the first year,<sup>19,35,37</sup> some studies have shown relief shortly after a band placement or within 6 months, citing these outcomes on the direct mechanical effect of the band, which could function as an antireflux barrier.<sup>30,35,37</sup> Overtightening of the band has been implicated as the reason for development of symptoms after a longer period of time.<sup>28,35,39</sup>

Owing to the conflicting results of studies evaluating laparoscopic adjustable gastric banding and GERD, many surgeons would not recommend this procedure if the patient has symptoms of GERD preoperatively.

## GASTROESOPHAGEAL REFLUX DISEASE AFTER SLEEVE GASTRECTOMY

Sleeve gastrectomy (SG), which was originally described as a first stage of the biliopancreatic diversion, is a relatively new treatment alternative for morbid obesity. It has become popular owing to its technical simplicity and its proven weight loss outcomes.<sup>41</sup> Although it has many positive effects on obesity and obesity-related comorbidities, the association between GERD and SG remains controversial.

Although some studies have reported improvement in GERD symptoms after SG, the majority of studies have reported an increase in GERD symptoms.<sup>42–47</sup> The International Sleeve Gastrectomy Expert Panel reported a postoperative rate of GERD symptoms after SG in up to 31%<sup>48</sup>; however, others cited increased GERD prevalence after surgery between 2.1% and 34.9%.<sup>49</sup>

### *Studies Showing an Increase in Gastroesophageal Reflux Disease After Sleeve Gastrectomy*

Several studies have shown an increase of GERD after SG at various time points. The comparison between different studies is difficult owing to variations in the definition of GERD. Although some have utilized the use of proton pump inhibitors as a diagnostic tool,<sup>43</sup> others have used the definition of typical heartburn and/or acid regurgitation occurring at least once per week.<sup>42</sup> Few studies used objective data to define reflux. Tai and colleagues<sup>42</sup> examined symptoms of GERD and erosive esophagitis at 1 year after laparoscopic sleeve gastrectomy (LSG). The groups concluded that there was a significant increase in the prevalence of GERD symptoms and erosive esophagitis ( $P < .001$ ), in addition to a significant increase in the prevalence of hiatal hernias ( $P < .001$ ), which was higher in patients who presented with erosive esophagitis after LSG. Others have shown a similar increase of GERD at 1 year.<sup>43,44</sup> Himpens and colleagues<sup>46</sup> compared adjustable gastric banding (AGB) and SG at 1 and 3 years after procedures. GERD seemed de novo after 1 year in 8.8% and 21.8% of patients with AGB and SG, respectively. At 3 years, however, rates changed to 20.5% and 3.1% in the AGB and SG groups. Another study followed patients for more than 6 years and reported 23% to 26% of patients reporting frequent episodes of GERD.

Various mechanisms have been postulated to cause symptoms of GERD after LSG (Table 1). As SG alters the gastroesophageal anatomy, it has been hypothesized that the anatomic abnormalities created contribute to the development of GERD in

**Table 1**  
**Proposed mechanisms leading to gastroesophageal reflux disease after SG**

<b>Anatomy</b>	
Tubular sleeve with inferior pouch	50
Concomitant presence of a hiatal hernia	45,55,60–62
Decrease in lower esophageal sphincter resting pressure	42,44,53,60,62–64
Increased intragastric pressure	53,62–64
Esophageal motility disorders	45,53
Increase in anatomic abnormalities	42,43,45,50,53,65–67
Incompetent pylorus	55
Intrathoracic sleeve migration	55
Fundal dilatation with distal narrowing	46,63,65
Reduced gastric compliance and reduces gastric volume	43,64
Altered gastric emptying	43,45,50,65,66
<b>Technique</b>	
Disrupt the integrity of sling fibers of Helvetius at esophagogastric junction	52
Stapling close to the angle of His	68
Narrowing incisura angularis leading to dilation of fundus	55,61
Dissection of phrenoesophageal ligament	55
Narrowing sleeve gastrectomy	67

Data from Refs. <sup>42–45,50,53,55,60–67</sup>

patients. Lazoura and colleagues<sup>50</sup> showed that the final shape of the sleeve can influence the development of GERD. The group showed that patients with tubular pattern and inferior pouch (preservation of the antrum) did better in terms of regurgitation and vomiting compared with a tubular sleeve with a superior pouch. Others have also suggested the importance of antral preservation to avoid GERD development.<sup>51</sup> An increase in acid production capacity can cause reflux in the case of an overly dilated sleeve, whereas impaired esophageal acid clearance can lead to reflux in a smaller sleeve.<sup>52,53</sup> Formation of a neofundus can in an effort to avoid fistulas may also lead to development of GERD.<sup>46</sup>

Daes and colleagues<sup>54</sup> further concentrated on describing and standardizing the procedure to reduce GERD symptoms. The authors identified 4 technical errors that led to development of GERD after the procedure: relative narrowing at the junction of the vertical and horizontal parts of the sleeve, dilation of the fundus, twisting of the sleeve, and persistence of hiatal hernia or a patulous cardia. By ensuring careful attention to surgical technique and performing a concomitant hiatal hernia repair in all patients, they reduced the rate of postoperative GERD to only 1.5%. The group concluded that hiatal hernia is the most important predisposing factor.<sup>54</sup>

### **Studies Showing Reduction of Gastroesophageal Reflux Disease After Sleeve Gastrectomy**

Several studies have reported either decreased or no association between GERD and LSG. Interestingly, in some of these studies, GERD improvement has been reported as a secondary outcome. Rawlins and colleagues<sup>55</sup> reported an improvement of symptoms in 53% of patients, but de novo GERD in 16% of patients. A multicenter prospective database review examined GERD in all 3 major bariatric procedures

and reported improvement in all. The authors used medication use to define GERD. A small portion of patients reported worsening GERD, which was highest in the SG group.<sup>17</sup> Sharma and colleagues<sup>56</sup> also reported an improvement of GERD as assessed by symptom questionnaires, as well as improvement in grade of esophagitis on endoscopy.

The possible mechanisms for improvement of GERD postoperatively are faster gastric emptying, reduction in gastric reservoir function, gastrointestinal hormonal modifications, decrease in acid secretions, and decrease in weight. Daes and colleagues<sup>54</sup> reported a decrease in incidence of GERD by using a standardized operative technique and concomitant repair of hiatal hernia. Other techniques used to minimize reflux after SG are listed in **Table 2**.

**Summary**

Owing to conflicting reports about the association between GERD and LSG, this procedure is controversial in patients with preexisting GERD. If LSG is considered in this population, hiatal hernia repair and meticulous technique are essential. We would like to emphasize the importance of preoperative testing to define the anatomy and evaluate preexisting GERD, esophagitis, Barrett’s esophagus, or the presence of hiatal hernia. Based on these findings, we counsel patients to the best procedure choice for them.

**PRESENTATION OF POSTPROCEDURE REFLUX DISEASE**

GERD is treated initially by clinical diagnosis on the basis of history and physical evaluation. Symptoms include heartburn, chest pain, regurgitation, nausea, and coughing. In postbariatric patients, symptoms of GERD can mask other postoperative complications. Previous undiagnosed motility disorders can worsen after bariatric surgery. In addition, surgery-specific postoperative complications can present as newly developed reflux symptoms. For example, in the case of the LABG, newly developed symptoms can be owing to malpositioned or an overtight band, band slippage, or

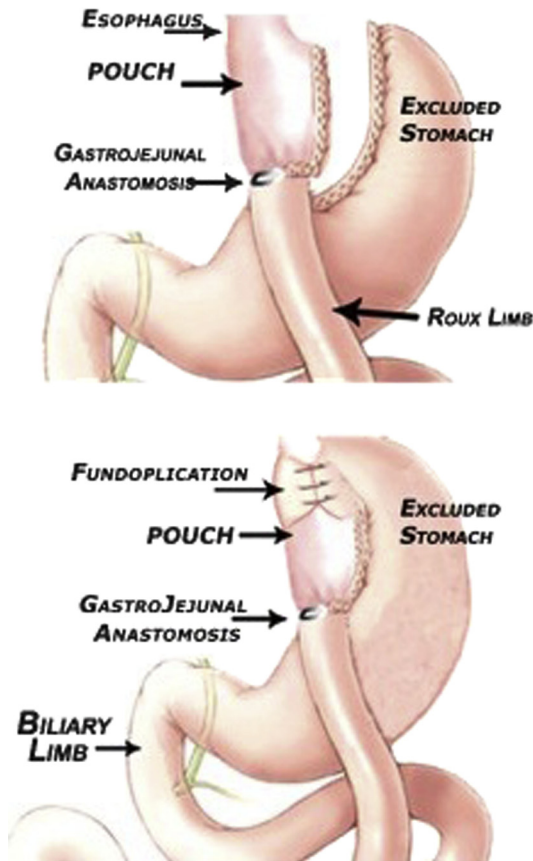
Table 2 Proposed mechanisms to minimize gastroesophageal reflux disease after sleeve gastrectomy	
Study	Recommendations
Daes et al, <sup>54</sup> 2014	Avoid twisting of the sleeve Avoid narrowing at the junction of the vertical and horizontal parts of the sleeve Avoid dilation of the fundus Repair of a hiatal hernia
Del Genio et al, <sup>52</sup> 2014	Preserve integrity of the sling fibers of Helvetius Avoid small bougie size (<40 Fr) Straight lumen Avoid leaving an excessive posterior gastric fundus
Dupree et al, <sup>53</sup> 2014	Avoid narrowing the gastric body or pylorus Repair concomitant hiatal hernias Attention to crural repair Attention to sleeve size and volume
Keidar et al, <sup>65</sup> 2010	Avoid creation of a narrow sleeve Do not place an excessive tension to the stomach Do not oversuture with overly big bites

Data from Refs.<sup>52–54,65</sup>

herniation. In the case of the RYGB, development of GERD can be owing to stenosis of the gastrojejunal anastomosis. Sleeve patients can also experience reflux with herniation, stricture, kinking, or dysmotility.

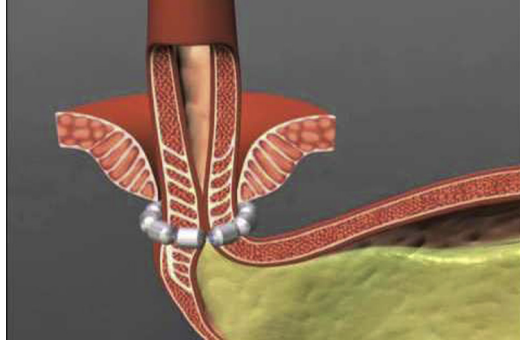
## DIAGNOSIS

Initial treatment of GERD in the postbariatric patient is medical therapy similar to that used in the general population. If symptoms continue or worsen despite pharmacologic therapy, further evaluation is needed. In case the bariatric procedure is performed at another institution, information about previous studies is helpful.<sup>57</sup> Several tests can aid the diagnosis of GERD, such as the 24-hour pH study, an upper gastrointestinal endoscopy and manometry. Of these studies, the 24-hour pH study is the gold standard for detection of GERD. Specifically, impedance studies can differentiate acid and nonacid reflux as well. Barium esophogram may also be helpful for detection of hiatal hernia or to help identify an outlet problem. An endoscopy can evaluate for Barrett's esophagus, esophagitis, or presence of a hiatal hernia. When



**Fig. 1.** Fundoplication over bypassed stomach. (From Kawahara NT, Alster C, Fauze MF, et al. Modified Nissen fundoplication: laparoscopic anti-reflux surgery after Roux-en-Y gastric bypass for obesity. *Clinics (Sao Paulo)* 2012;67(5):532.)





**Fig. 2.** Linx procedure. (Courtesy of Torax Medical, Inc, Shoreview, MN; with permission.)

performing an endoscopy, the gastroenterologist or surgeon should be aware of the exact bariatric procedure performed and the resulting anatomy, specifically gastric pouch or sleeve size, anastomotic characteristics, and potential fistulae.

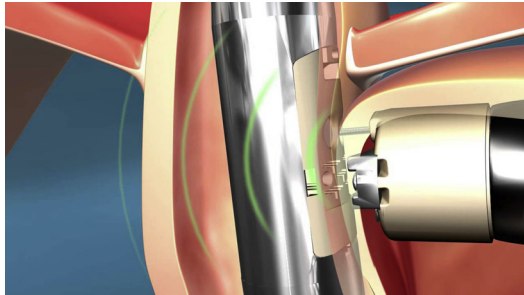
### TREATMENT

As described, initial treatment is similar to that in the general population. Proton pump inhibitors are first-line medications. Proton pump inhibitors are first-line medications. Promotility agents can also be used. When symptoms persist and further evaluation cannot find a specific cause for the symptoms, revision surgery can be considered.

### AVAILABLE PROCEDURES

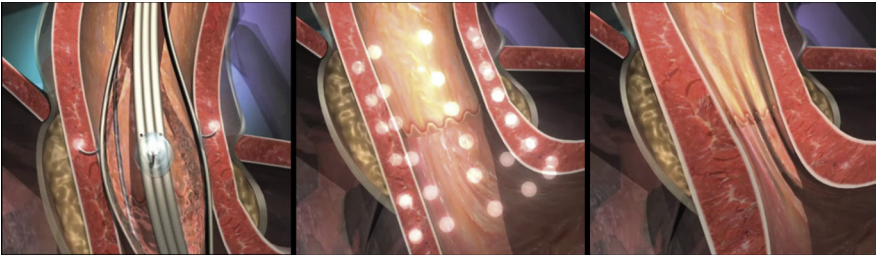
Inadequate weight loss and uncontrollable reflux are the most common indications for revisional bariatric surgery. Depending on procedure, there are several possibilities. In case of the AGB and SG, conversion to RYGB has been shown to be safe and successful. Langer and colleagues<sup>58</sup> demonstrated a successful conversion of SG to RYGB for 3 patients. After surgery, improved reflux in all 3 patients was reported and patients were able to discontinue acid-suppressive medications.<sup>58</sup>

Patients with newly developed GERD symptoms after RYGB may have several possibilities. A revision of the bypass is a possibility to lengthen the Roux limb and/or downsize the gastric pouch. A case of conversion to a Belsey Mark IV fundoplication has also been described in the literature, although that is not standard.<sup>59</sup> Other surgeons have proposed fundoplication using the bypassed stomach (**Fig. 1**).



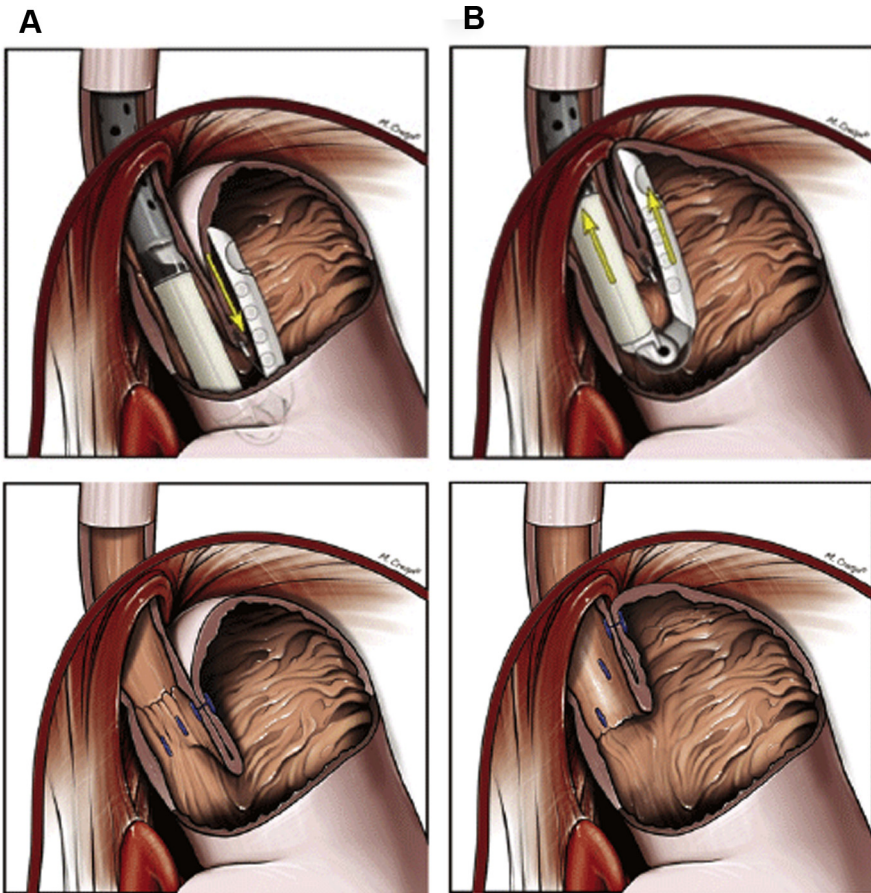
**Fig. 3.** The MUSE system. (Courtesy of Medigus LTD, Omer, Israel; with permission.)





**Fig. 4.** Stretta procedure. (Courtesy of Mederi Therapeutics Inc, Norwalk, CT; with permission. © 2015 Mederi Therapeutics Inc.)

As new techniques continue to develop, such as the Linx device ([Fig. 2](#)), the MUSE system ([Fig. 3](#)), Stretta Procedure ([Fig. 4](#)), and EsophyX ([Fig. 5](#)), among other endoluminal therapies, new choices emerge. These procedures may be performed either postoperatively in patients with newly developed reflux or concurrently in patients



**Fig. 5.** EsophyX procedure. (A) TIF 1 procedure with gastrogastric plications placed at the level of the Z-line. (B) TIF 2 creates an esophagogastric fundoplication proximal to the Z-line. (From Bell RC, Cadere GB. Transoral rotational esophagogastric fundoplication: technical, anatomical, and safety considerations. *Surg Endosc* 2011;25(7):2387–99.)

desiring procedures such as a Sleeve; however, no data are available currently for these approaches.

## SUMMARY

GERD is a significant comorbidity in bariatric patients preoperatively and postoperatively. Surgeons should be aware of appropriate evaluation, procedures choices, and management options. Revision surgery for reflux symptoms is common and appropriate anatomy and outcomes should be considered when offering these interventions to our patients. Patient selection is important to ensure avoiding postoperative development or worsening of GERD.

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