Laparoscopic management of reflux after Roux-en-Y gastric bypass using the LINX system and repair of hiatal hernia: a case report

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Roux-en-Y gastric bypass (RYGB) has been advocated for the treatment of gastroesophageal reflux in obese and nonobese patients [1,2]. Its effect in the resolution of reflux symptoms has been shown to be independent of weight loss [3,4]. The mechanism of its action in controlling reflux is reducing parietal cells in the stomach pouch as well as diverting bile via the jejuno-jejunal anastomoses. Unfortunately, this mechanism does not address the role of a weak lower esophageal sphincter (LES) and transient LES relaxation (TLESR) as contributing factors in reflux symptoms [5,6]. Managing patients who present with reflux after RYGB can be challenging. Revision of the gastric pouch has been described along with other procedures to treat this problem. We present a case of laparoscopic augmentation of the LES using the LINX system (Torax Medical, Inc., Shoreview, Minnesota) and repair of hiatal hernia to control reflux after RYGB.

Case history

The patient was a 56-year-old female who underwent RYGB in 2007. She had a history of mild reflux at that time. Her weight was 260 lbs. with a body mass index (BMI) of 49.1 kg/m². The patient had good weight loss and reached a BMI of 24.1 in 2011; however, in spite of that, her reflux worsened after 4 years, with weight regain. She was treated aggressively with proton pump inhibitors without resolution of symptoms. Her weight had stabilized over the last 4 years. She presented to our office with a weight of 169 lbs. and BMI of 31.9 kg/m². The patient was studied extensively with upper gastrointestinal imaging (UGI), which showed moderate reflux with mild dilation of the gastric pouch (Fig. 1). She also underwent direct endoscopic visualization of her esophagus, gastric pouch, gastro-jejunal anastomosis, and jejunal limb. A small hiatal hernia was noted. A Bravo pH monitor capsule (Given Imaging, Duluth, Georgia) was placed at the same time. Her Bravo pH DeMeester score was elevated at 27.7 (normal <14.7). Esophageal motility using a ManoScan ESO high-resolution esophageal motility manometer (Given Imaging, Duluth, Georgia) was performed as well, which showed normal esophageal motility with mean lower esophageal sphincter pressure of 11.3 mm Hg (normal <15.0).

The patient was offered a revision of her gastric pouch to reduce it, along with repair of the small hiatal hernia to treat the reflux. The patient declined the procedure, fearing potential complications related to the revision. In addition, she stated she was satisfied with her weight and did not want a further reduction in the gastric pouch size. As an alternative, we offered her the LINX system procedure based on our previous experience with this technique in managing reflux in 4 patients after sleeve gastrectomy as well as in nonobese patients. The patient agreed to undergo this procedure. She consented to the operation with the understanding that it was an off-label use of the device and that there were no reports, so far, of other patients with similar conditions who had undergone the procedure in the United States. The case was reviewed and approved by the hospital institutional review board.

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Results

The procedure was performed laparoscopically on December 4, 2015. The hiatal hernia was repaired with a 40-French Bougie. A 13-mm LINX device was placed around the distal esophagus (Fig. 2). The operative time was 71 minutes. There were no intraoperative or postoperative complications. On postoperative day 1, UGI was performed and showed the device to be in good position, with no reflux (Fig. 3). The patient was placed on a regular diet of small, frequent meals and discharged home that afternoon. She reported no reflux symptoms immediately after the operation and stopped using her proton pump inhibitor after 1 week. Six weeks later, the patient’s Health Quality of Life score had improved from 21/75 preoperatively to 0/75 postoperatively, with excellent patient satisfaction reported. The repeat Bravo test showed a DeMeester score of 9.5.

Discussion

RYGB is the procedure of choice for morbidly obese patients with reflux; unfortunately, it does not resolve reflux in all patients. In a review of a longitudinal database of the effect of various bariatric procedures in resolving reflux in 116,136 patients, Pallati et al. [7] found improvement in reflux score in only 56.5% of patients (7955 of 14,078) who underwent RYGB with hiatal hernia repair. Furthermore, in a survey of 35,477 patients in the Michigan Bariatric Surgery Collaborative database on the use of antireflux medications (ARMs) 1 year after the bariatric procedure, Verban et al. [8] reported on 22,109 patients who completed the baseline survey and 10,766 who completed the 1-year...
follow-up survey. The data showed that among patients who used ARMs preoperatively and underwent RYGB, 43.8% continued to use the medications after the operation, and 19.2% became new users. This survey, however, did not indicate whether the continued use of ARMs was for reflux alone or for other reasons, such as marginal ulcer disease.

Some authors believe that reflux after RYGB is due to leaving behind too much gastric pouch during the original surgery, allowing the remaining parietal cells to continue to produce acid. Another proposed cause is surgical creation of a short alimentary limb that allows bile to reflux back. These authors advocate revision procedures to either reduce the size of the pouch or lengthen the alimentary limb [9,10].

Revision of RYGB and revision to RYGB after fundoplication has been advocated for patients with recurrent reflux [11]. Because these revision procedures carry with them a higher risk of complication than the original procedure, the authors caution that revisions must be performed by experienced surgeons. In a study by Zhang et al., comparing revision of RYGB with the primary procedure, there was greater blood loss as well as longer operative times, intensive care unit stays, and hospital length of stay with revision procedures. There also were significantly more intraoperative liver and spleen injuries and more enterotomies, with more postoperative complications, readmissions, and reoperations within 30 days of surgery [12].

However, these procedures do not address the problem of weak LES or TLESR as factors in the recurrence of reflux. In our patient, the LES mean residual pressure was normal, indicating that her problem was probably secondary to TLESR. A literature review revealed 2 case reports addressing these issues; one reported on a modified Nissen fundoplication performed using the de-functionalized stomach, and the other used the dilated gastric pouch in a Belsey Mark IV fundoplication [13,14]. Another nonoperative report described use of the Stretta radiofrequency energy system (Mederi Therapeutics, Greenwich, Connecticut) to correct the reflux [15].

The LINX system was approved by the FDA in 2012 for treatment of reflux in the general population as an alternative to the gold standard, Nissen fundoplication. Its mechanism in controlling reflux is by augmenting the LES pressure with its magnetic beads [16]. Based on our unpublished experience of excellent results using the LINX system to treat 4 patients with reflux after sleeve gastrectomy, we believed the same could be achieved in the current patient with reflux after RYGB. The results we achieved did confirm our theory that the LINX system may be valuable for managing reflux after RYGB in selected patients.

In addition to the LINX system, the repair of the small hiatal hernia may have been a contributing factor in the control of reflux in our patient. The use of a 40-French Bougie was dictated by the patient’s small mouth, as a larger bougie (56 French) could not be passed through. Pallati et al. [7], however, showed that the repair of hiatal hernia alone at the time of RYGB was not associated with the same success in controlling reflux (56.5%) as we report with the addition of the LINX system.

Our good results in controlling reflux as well as the short operative time, relative safety, and quick recovery in this patient suggest that the LINX device may be an option in treating reflux after RYGB without revision. However, revision may be a better option if significant weight regain is present along with reflux symptoms, wherein reduction in the gastric pouch size would both reduce the number of acid-producing parietal cells and help in reducing weight. This, unfortunately, would not address the bile reflux, and revision of the jejuno-jejunal anastomosis would still be needed. The LINX system, on the other hand, may control acid and bile reflux at the same time.

**Conclusion**

In this case, laparoscopic use of the LINX system in combination with hiatal hernia repair for treating reflux symptoms was an acceptable, safe procedure in a patient who achieved good weight loss after RYGB. The addition of the LINX system to the armamentarium for treating reflux after RYGB can be beneficial in selected patients. The technique can control both acid and bile reflux. It is a reasonably short procedure with a quick recovery time and potentially lower complication risk than revision surgery, especially when weight regain is not a concomitant problem.

**Disclosures**

*The authors have no commercial associations that might be a conflict of interest in relation to this article.*

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