Reoperative Antireflux Surgery

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KEYWORDS

• Gastroesophageal reflux disease • Nissen fundoplication • Revisional surgery
• Roux-en-Y gastric bypass • Collis gastroplasty • Preoperative evaluation
• Outcomes

KEY POINTS

- The most common symptoms leading to reoperative antireflux surgery are recurrent heartburn, dysphagia, and regurgitation.
- The most common anatomic abnormalities found at the time of revisional surgery include slipped fundoplication, malpositioned wrap, intrathoracic wrap migration, and complete or partial wrap disruption.
- Success rates for revisional surgery are lower than primary antireflux surgery; despite this, greater than 80% of patients undergoing redo surgery are satisfied with their results.
- Reoperative antireflux surgery is technically challenging and should be performed by experienced foregut surgeons.

INTRODUCTION

Gastroesophageal reflux disease (GERD) is a common problem in the United States, affecting an estimated 40% of the adult population.[1] Since the widespread use of laparoscopic surgery, an increasing number of antireflux operations have been performed.[2] Surgical treatment of GERD has had mixed success. As many as 50% of patients resume antireflux medications after surgery,[3] often without objective evidence of true recurrent reflux disease.[4,5] Patient satisfaction up to 5 years after surgery is as high as 90%.[6–11] Between 3% and 10% of patients require reoperative antireflux surgery.[5,9,12–15]

No standard definition of what constitutes failure of antireflux surgery exists. Failure may be defined subjectively as return of symptoms, use of antacid

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medications, and patient dissatisfaction. Failure may also be defined objectively through esophagogastroduodenoscopy (EGD), pH studies, and radiographic imaging, which can identify recurrent hiatal hernias, wrap disruption, and/or recurrent reflux disease.

Revisional surgery is substantially more complex than initial antireflux surgery. A thorough preoperative evaluation is necessary to aid in operative planning and to ensure that the patient is an appropriate candidate for a particular revisional procedure. The most common indications for revisional surgery are recurrent symptoms of heartburn, recurrent hiatal hernia, and/or dysphagia. Other potential indications include misdiagnosis of initial symptoms and inadequate surgical technique.[16,17]

Several surgical approaches are available, including abdominal or thoracic access with either open or laparoscopic/thoracoscopic techniques. Options for revision surgery include redo fundoplication with or without a Collis gastroplasty, hiatal hernia repair if present, conversion to Roux-en-Y (RNY) anatomy, or esophagectomy. As surgeons have increased laparoscopic experience, minimally invasive redo antireflux surgery is becoming the gold standard, as is seen with primary antireflux surgery.

RISK FACTORS CONTRIBUTING TO SURGICAL FAILURE

Multiple reasons exist for failure of antireflux surgery. Both patient and technical factors can play a role in wrap failure or return of symptoms. Patient-specific risk factors include morbid obesity, atypical symptoms, lack of response to medications, chronic coughing, retching, preoperative poor esophageal peristalsis with excessive supine acid exposure, larger hiatal hernia, female gender, or age older than 50 years.[18–23]

Several technical errors at the time of initial operation can lead to failure. Common reasons include inadequate crural closure, misplaced wrap, failure to recognizing a short esophagus, and creation of a wrap that is too loose or too tight.[17,24,25]

CLINICAL PRESENTATION AND ETIOLOGY OF FAILURE

It is common for patients to have a variety of symptoms after Nissen fundoplication, such as bloating, increased flatus, inability to vomit or belch, and temporary mild dysphagia. These symptoms are usually self-limited and can be managed conservatively. The most common symptoms that lead to reoperative antireflux surgery are recurrent reflux, dysphagia, and regurgitation.[26]

Furnée and colleagues[16] performed a systematic review of the literature of failed antireflux surgery. They identified more than 4500 patients who underwent reoperative antireflux surgery. The most common indications for surgery were recurrent reflux and dysphagia. They reported wrap disruption, slipped fundoplication, and intrathoracic wrap migration as the most frequent anatomic abnormalities found at the time of reoperation (**Fig. 1**). Other less frequent abnormalities seen were hiatal disruptions, wraps that were too tight, and stricture. Several patients were thought to have had reflux surgery in error, with their actual diagnoses being achalasia, esophageal dysmotility or spasms, scleroderma, and esophageal cancer. Of the 81 studies included in their review, 5 summarized anatomic abnormalities based on the approach (open or laparoscopic) of the primary operation and the indications for reoperations (**Table 1**).[12,27–30] In patients with recurrent reflux as their presenting symptom, intrathoracic wrap migration and wrap disruption were most commonly seen. In patients with dysphagia as the presenting symptom, up to 40% of patients had no identified cause of failure at reoperation.

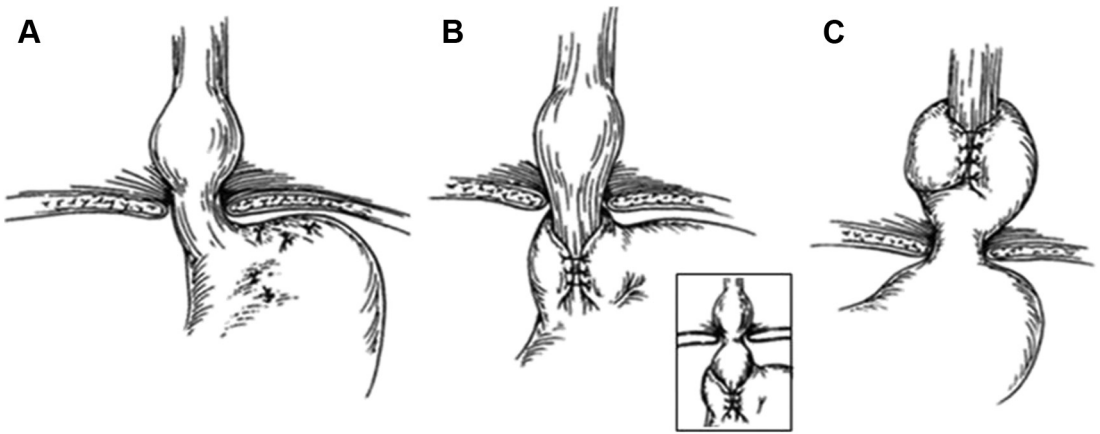


Fig. 1. Pattern of failure of primary repair. (*A*) Complete disruption, (*B*) slipped Nissen fundoplication, and (*C*) transhiatal herniation. (*From* Pennathur A, Awais O, Luketich JD. Minimally invasive redo antireflux surgery: lessons learned. Ann Thorac Surg 2010;89(6):S2175; with permission.)

Table 1
Anatomic abnormalities based on primary surgical approach and indication for reoperation

	Approach	
Anatomic Abnormality	**Open, n = 120**	**Laparoscopic, n = 132**
Wrap disruption	48 (40.0)	24 (18.2)
Telescoping	32 (26.6)	10 (7.6)
Hiatal disruption	23 (19.2)	42 (31.8)
Tight wrap	2 (1.7)	24 (18.2)
Miscellaneous	36 (30.0)	42 (31.8)
	Indication	
Anatomic Abnormality	**Recurrent Reflux, n = 234**	**Dysphagia, n = 11**
Intrathoracic wrap migration	104 (44.4)	18 (15.3)
Wrap disruption	109 (46.6)	12 (10.2)
No cause of failure	34 (14.5)	51 (43.2)
Miscellaneous	64 (27.4)	54 (45.8)

Data are presented as n (%). Totals do not equal 100% because some cases had multiple causes of failure.

Data from Furnée EJ, Draaisma WA, Broeders IA, et al. Surgical reintervention after failed antireflux surgery: a systematic review of the literature. J Gastrointest Surg 2009;13:1539–49.

EVALUATION

Because reoperative surgery is considerably more difficult than initial antireflux surgery, a thorough preoperative evaluation is essential. A comprehensive history and physical examination, with effort focused on identification of both initial and recurrent symptoms, is important. A review of the medical records, including pH and manometry studies, endoscopy reports, radiographic images, and operative reports, can offer insight into potential causes of recurrent symptoms. Details of the operative report must be carefully reviewed for the presence and size of hiatal hernia, management of hernia sac, extent of mediastinal dissection, identification and preservation of the vagus nerves, intra-abdominal esophageal length, division of short gastric vessels, crural closure (use of pledgets or mesh and type of mesh used), and type of fundoplication performed. This information can provide insight into the causes of failure and what to expect at reoperation. In addition, inquiring about symptom relief after the initial operation and any inciting events (ie, traumatic accident, episodes of retching, or significant weight gain) can be important in identifying potential cause of failure. As part of the physical examination, it is important to assess for morbid obesity because this condition is an independent risk factor for failed antireflux surgery.[18] Conversion to Roux-en-Y gastric bypass (RNYGB), as discussed later, should seriously be considered as the revision surgery of choice in this patient population.

An in-depth investigation with repeat EGD, upper gastrointestinal swallow study, and pH probe with impedance or Bravo probe should be obtained. If manometry was not performed before the initial operation, it should be considered to look for an esophageal motility disorder that could account for recurrent symptoms and affect future surgical care. A nuclear medicine gastric emptying study should be performed if there are symptoms of vomiting or severe gas bloat.

It is important to have objective evidence of reflux before undertaking revisional surgery in patients whose primary symptom is recurrent heartburn. Findings of

esophagitis on endoscopy or an elevated DeMeester score on a pH study provide objective findings that support a diagnosis of recurrent reflux disease. Patients with dysphagia as the presenting symptom may not have an obvious cause, necessitating a thorough preoperative workup.

If a recurrent hiatal hernia is found in a symptomatic patient, it is not necessary to verify the presence of reflux disease; however, not all patients with recurrent hiatal hernia need reoperative surgery because many are asymptomatic or minimally symptomatic.

OPERATIVE APPROACHES

The conventional approach to reoperative antireflux surgery has been either open abdominal or open thoracic,[16,31] but with increasing experience and skill in laparoscopic surgery, minimally invasive techniques are being used more frequently. The complexity of the operation is far greater than the primary surgery, related to adhesion formation and altered anatomy. These operations should be performed by experienced laparoscopic foregut surgeons. Conversion to open surgery is occasionally required, but in experienced hands that rate can be as low as 1% to 2.5%.[25,26] The most common operation performed for failed antireflux surgery is redo fundoplication with hiatal hernia repair when needed.[25,26,32]

Description of Redo Laparoscopic Fundoplication

The patient is positioned in lithotomy and steep reverse Trendelenberg position. An open Hasson technique is used to gain access to the abdominal cavity, with care taken to avoid injury to intestines that may be adhered to the anterior abdominal wall from prior surgery. Following insufflation with CO_2, a 10-mm trocar is placed under direct visualization along the left mid-clavicular line just inferior to the costal margin. Two 5-mm trocars are also introduced, one in the left lateral abdomen and the other in the right upper abdomen, close enough to the falciform ligament to advance it from the right side of the abdomen to the left, if necessary, through the falciform. It is typical at this point to have significant adhesions of the liver to the stomach and prior wrap. The use of blunt and sharp dissection is used to carefully perform adhesiolysis. A thermal energy source can be used selectively and judiciously. Care should be taken to avoid inadvertent injury to the stomach or liver. It is helpful to dissect through the pars flaccida and use this posterior plane to advance the dissection toward the esophageal hiatus. Visualization of the caudate lobe of the liver can serve as a landmark for the dissection. Care is taken to not dissect behind this to prevent injury to the vena cava. As the liver and stomach are freed from adhesions, a liver retractor is placed through a separate incision to provide exposure for the remainder of the case. Once the crural pillars are identified, careful circumferential dissection of the distal esophagus and proximal stomach is performed. Once again, dense adhesions are typically encountered, and care must be taken to avoid injury to the visceral organs. Use of an endoscope or lighted bougie is extremely beneficial in helping to identify the esophagus during the mediastinal dissection. If there is recurrence of a hiatal hernia, complete hernia sac dissection and reduction is performed. This procedure can be technically challenging because of mediastinal adhesions. If a pneumothorax occurs, it is important to have good communication with the anesthesia team, owing to the potential for hemodynamic instability. It may be necessary to decrease pneumoperitoneum pressures. A chest tube is rarely needed, so long as there is no parenchymal lung injury. The anterior and posterior vagus nerves are identified and protected from injury. The goal is to restore normal anatomy, which includes ensuring that the gastroesophageal (GE) junction is intra-abdominal and that

the prior fundoplication is taken down with the fundus returned to its normal position. Previously placed wrap sutures can often be visualized and can aid in identifying a plane to achieve wrap takedown. A useful technique is to use a linear stapler to divide the gastrogastric fundoplication. The fundus should be returned to its original anatomic position, which typically involves lysis of posterior adhesions where the wrap is adherent to the stomach and crus.

Once normal anatomy has been reestablished, assessing the intra-abdominal esophageal length is critical. There should be at least 2 to 3 cm of tension-free intra-abdominal esophagus. If this is not the case, continued mediastinal dissection of adhesions around the esophagus can often aid in mobilizing the GE junction further into the abdominal cavity. If this is not successful, a Collis gastroplasty should be performed; this can be accomplished with linear staples to fashion a wedge gastroplasty (**Fig. 2**) or with the use of an end-to-end stapler followed by the use of a linear stapler (**Fig. 3**). Crural repair is then undertaken and should follow the same surgical principles as used with primary hiatal closure. The authors use a permanent braided suture placed posteriorly, including the peritoneum that overlies the crural pillars. If closure requires more than 3 sutures or there is tension on the closure, the authors use an absorbable synthetic mesh (GORE Bio-A, W. L. Gore & Associates, Inc, Newark, DE, USA) to reinforce the repair. Care is taken to place the mesh such that it is not in direct contact with the esophagus. The fundus is again delivered posterior to the stomach, and a floppy 2.5-cm Nissen fundoplication is performed.

OUTCOMES

Long-term satisfaction rates after initial antireflux surgery are as high as 90%.[33] Satisfaction after primary revision antireflux surgery is lower but remains high at greater than 80% in multiple studies.[12,17,25,28,31] The GERD health-related quality of life (HRQL) questionnaire is the most commonly used tool to assess this. Several studies have reported on objective outcomes after laparoscopic reoperation, assessed by normal acid exposure on pH monitoring or lack of esophagitis on endoscopy, with a success rate greater than 80%.[25,27,31]

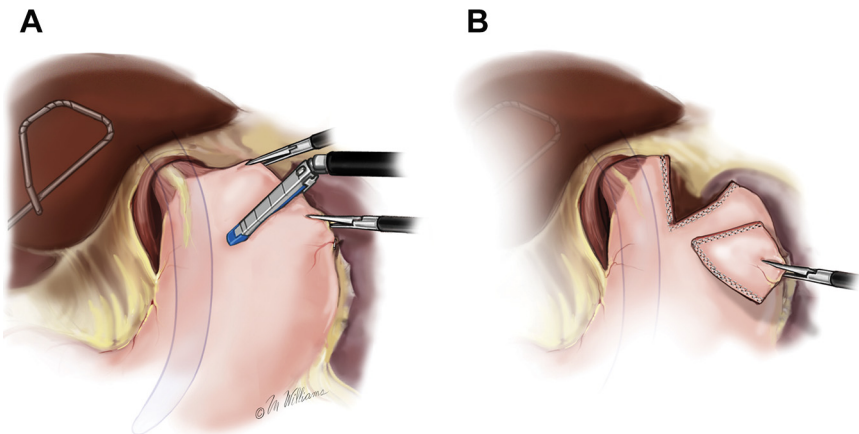


Fig. 2. (*A*) Collis lengthening procedure. Graspers are used to stabilize the stomach. (*B*) A reticulating Endo-GIA stapler (Covidien, Minneapolis, MN) is used to form a wedge of gastric cardia. (*Courtesy of* Marcia Williams, Santa FE, NM; with permission.)

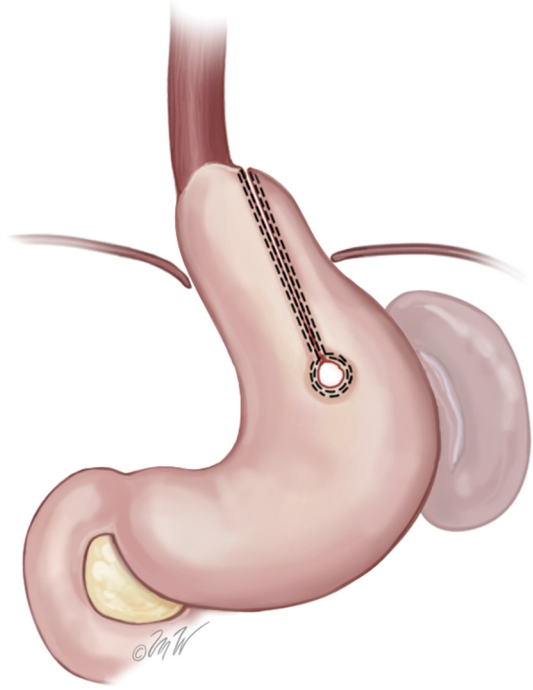


Fig. 3. Extraesophageal length can be achieved by creating a stapled gastric tube or Collis gastroplasty. This procedure can be done by using an end-to-end stapling technique. (*Courtesy of* Marcia Williams, Santa FE, NM; with permission.)

Intraoperative complication rates are higher with revisional surgery. In a systematic review of the literature, Furnée and colleagues[16] reported intraoperative and postoperative complication rates of 21.4% and 15.6%, respectively. The most common intraoperative complication was injury to the stomach or esophagus, which occurred in 13.1% of cases. Other specified intraoperative complications included pneumothorax (3.4%), hemorrhage (1.9%), and splenectomy (0.3%). The most frequent postoperative complications were infections and pulmonary and cardiac complications. Despite the high gastric or esophageal injury rates, a postoperative leak was reported in only 1.5% of patients. The researchers found a higher overall intraoperative complication rate in the laparoscopic group, 19.5% versus 5.4% in the open group. Alternatively, postoperative complication rates with open surgery were higher when compared with laparoscopic operation, 17.4% versus 15.3%, and 30-day mortality rates of 1.3% versus 0%, respectively. Conversion from laparoscopic to open surgery occurred in 8.7% of laparoscopic cases because of dense adhesions, intraoperative bleeding, and poor visualization.[16]

In a single-institution series of 275 redo operations by Awais and colleagues,[31] the most commonly identified cause of failure was recurrent hiatal hernia, found in 64% of patients. Other identified causes included short esophagus (43%), misplaced wrap (16%), wrap too loose or too tight (14%), and a disrupted wrap (4%). Laparoscopic surgery was attempted in 266 of these patients, with a rate of conversion to open surgery of 3%. With a median follow-up of 3.3 years, 11% of patients had failure of the redo operation, necessitating another surgical intervention. Although the investigators did not report on the frequency of intraoperative visceral injury, the postoperative leak

rate was 3.3%. They reported no perioperative mortalities. From the GERD-HRQL questionnaire, 85% of patients were satisfied with their results. They concluded that minimally invasive redo antireflux procedures can be safely performed in an experienced center. Despite redo operations having poorer outcomes than initial surgery, they achieved a patient satisfaction rate of greater than 80%.

FAILURE OF REDO FUNDOPLICATION

Approximately 10% of patients undergoing laparoscopic reoperative antireflux surgery require another redo procedure.[31,34] Some patients have undergone as many as 4 revisional surgeries.[35,36] There is an increasing trend toward conversion to RNY anatomy with either a gastrojejunal (GJ) or esophagojejunal (EJ) anastomosis.[31,35–37] Other options include redo fundoplication with or without a Collis gastroplasty or esophagectomy. If a shortened esophagus is the cause of failure and was not treated during previous operative approaches, it may be appropriate to perform a second redo fundoplication with a Collis gastroplasty. In cases with significant esophageal dysfunction, an esophagectomy may be performed as a last resort.[24,26,31,37]

Performing a RNY reconstruction may become the operation of choice after failed primary or reoperative antireflux surgery. Little and colleagues[38] reported a satisfaction rate of only 42% in patients requiring 3 or more open operations. Rather than replication of the same procedure, conversion to RNY may be a better option. The RNY anatomy acts to separate most of the acid-producing parietal cells from the esophagus, thus preventing esophageal reflux disease. Creating a small gastric pouch, as is done in weight loss surgery, is important for successful treatment of reflux disease because retained parietal cells in a large gastric pouch can be a source of recurrent acid reflux. Obesity is a well-known independent risk factor for antireflux surgery failure, so conversion to RNYGB should seriously be considered as the operation of choice after failure of initial antireflux surgery[39–41] in the obese or morbidly obese population.

Another study by Awais and colleagues[37] reported on 25 patients with recurrent GERD after reflux surgery who underwent a “RNY near esophagojejunostomy”, which they defined as a standard RNYGB, but with a smaller, 5- to 10-cm gastric pouch.[3] The goal of the small pouch is to have only gastric cardia, thus eliminating any acid production within the gastric pouch. In their series, 28% of patients had a body mass index less than 30 kg/m^2. About 44% of patients had more than 1 prior reflux operation. Patients reported significant improvements in heartburn, regurgitation, and dysphagia symptoms. Patient satisfaction rates after surgery were 80%, which far exceeds the 42% satisfaction rate after multiple redo fundoplications as reported by Little and colleagues.[38]

Makris and colleagues[36] reported on their single-institution experience with 72 patients who underwent conversion of failed fundoplication to RNY reconstruction; this included a combination of open and laparoscopic operations and reconstruction to a gastric pouch or the esophagus. Intraoperative complications were common, occurring in 43% of patients. Ten patients had intraoperative injury to the esophagus or GE junction. Despite the high complication rate, they reported zero 30-day mortality and a high patient satisfaction rate. With long-term follow-up, 89% of respondents indicated that they would refer a friend who was having similar symptoms.

Published perioperative major and minor complication rates with conversion to RNY reconstruction are high, ranging from 21% to 46%. Overall patient satisfaction rates from these same studies are similar to the initial antireflux surgery, 88% to 96% (**Table 2**).[35,36,39,42,43]

Table 2
Conversion of fundoplication to Roux-en-Y gastric bypass

Author, Publication Year	N	Preoperative BMI (kg/m^2)	Conversion to Open (n)	30-d Complication Rate (%)	30-d Mortality (n)	Patient Satisfaction (%)
Stefanidis et al,[35] 2012	25	24.4	2/24	40	0	96
Makris et al,[36] 2012	72	31.4	9/46	46	0	89
Houghton et al,[42] 2005	19	42.0	1/3	21	0	88
Kellogg et al,[43] 2007	11	44.0	0	45	0	NR
Zainabadi et al,[39] 2008	7	39.4	1/7	43	0	NR

Complication rate includes major and minor complications.
Abbreviations: BMI, body mass index; NR, not reported.
Data from Refs.[35,36,39,42,43]

RNYGB can be used in the nonobese patient, as excessive weight loss is typically not seen in patients of normal weight.[36,44] In this patient population, it has been the authors' practice to use this approach after 2 prior failed fundoplications. Esophagectomy is occasionally required in patients with multiple failed redo operations.[16,26,31] It is the authors' belief that earlier conversion to RNYGB can aid in preserving the esophagus.

SUMMARY

Antireflux surgery has a high success rate, with most patients being satisfied with their results. A small percentage of patients need reoperative treatment of new, persistent, or recurrent symptoms. Causes of failure include a variety of patient and technical factors. A complete patient evaluation and workup is necessary before proceeding with revisional surgery, including reviewing medical records, taking a detailed history, and obtaining appropriate studies and tests to verify recurrent disease. Attempts should be made to preserve the esophagus whenever possible. If a short esophagus is found, a Collis gastroplasty should be used to create adequate intra-abdominal esophageal length. If a hiatal hernia is present, the hernia sac must be completely dissected and reduced. If the patient has failed reoperative antireflux surgery or is considerably overweight, conversion to RNY anatomy should be performed. Success rates of reoperative surgery are inferior to those of primary surgery, and complications are considerably more common. Despite these challenges, surgeons with significant experience in foregut surgery can perform these complex operations, providing symptom relief and improved quality of life for a substantial majority of patients.

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