


Surgical Perspective on Evaluation and Management of Recurrent Reflux After Primary Antireflux Surgery

Foregut
2023, Vol. 3(4) 500–504
© The Author(s) 2023
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/26345161231170570
journals.sagepub.com/home/gut


Thomas H. Shin¹ and Matthew D. Kroh¹

Abstract

While fundoplication as a treatment for gastroesophageal reflux disease (GERD) has been largely successful, the rise in reflux cases refractory to initial surgery presents a unique challenge in the search for more durable symptom relief. In addition to principles pertaining to medical management and reoperation, this article discusses several nuances to consider in the careful evaluation of recalcitrant GERD post-fundoplication to optimize long-term success after revisional antireflux surgery from a surgical perspective.

Keywords

antireflux surgery, refractory acid reflux, fundoplication failure

Introduction

As one of the most prevalent gastrointestinal diagnoses made in the United States, gastroesophageal reflux disease (GERD) has been responsible for up to an estimate of 9 million outpatient clinic visits in the United States with an adult population incidence rate of up to 40%.^{1,2} Various studies have shown an upwards of 90% patient satisfaction rates after laparoscopic Nissen fundoplication, which has often been referenced as the gold standard antireflux procedure for GERD refractory to medical therapies.³⁻⁶ While durable symptom control is achieved in most patients, approximately 3% to 10% of primary fundoplication patients require a reoperation for recurrence.⁷⁻⁹ Given known significant intraoperative complication and postoperative morbidity of reoperative antireflux surgery, prudent decision-making and discerning diagnostics become imperative before embarking on revisional surgery, especially given similarities between symptoms of recurrent GERD and myriad of other foregut symptoms versus expectant postoperative course.¹⁰

Most antireflux fundoplication procedures are completed using a laparoscopic approach, including the total or Nissen fundoplication and the partial anterior or posterior fundoplication. Though more often reserved for revisional surgeries, lack of intraabdominal esophageal length may necessitate a concomitant Collis gastroplasty to ensure tension-free positioning of the stomach under the diaphragm. While various factors play a role in determining surgical appropriateness of each of these procedures,

including underlying esophageal dysmotility and anatomic variation, these procedures may result in early postoperative dysphagia, odynophagia, epigastric or chest pain, nausea, vomiting, and globus sensation.¹¹

Reflux Recurrence: Presentation, Differential, and Causes

Interestingly, the most common reported symptoms prompting consideration for revisional antireflux surgery also include many of the same above-listed postoperative symptoms. It has been demonstrated that the most common symptoms associated with revisional surgery were subjective reports of recurrent reflux, dysphagia, and regurgitation.^{1,12} Many of these symptoms are often described by patients in the short to medium postoperative term after primary antireflux surgery, which confounds the clinician's ability to discern whether symptoms are due to refractory GERD or expected post-surgical sequelae. This is perhaps further unclear given that there is no unified consensus on the definition of primary fundoplication failure. From a clinical perspective, fundoplication failure may go beyond reported symptoms and

¹Cleveland Clinic Foundation, Cleveland, OH, USA

Corresponding Author:

Matthew D. Kroh, Digestive Disease and Surgery Institute, Cleveland Clinic, 9500 Euclid Avenue, A100, Cleveland, OH 44195, USA.
Email: krohm@ccf.org

patient dissatisfaction to include continued need for antacid medications.

There is, however, consensus that corroboration of clinical symptoms with objective measures of reflux is imperative to accurately diagnosing fundoplication failure and the need for surgical revision, rather than medical non-operative management.^{1,11,12} Use of antisecretory medication alone is a poor proxy of true acid exposure. Additional workup for the above clinical symptoms is to primarily address the fact that most primary fundoplication failures are resultant of a technical failure and/or an incorrect underlying diagnosis. Recurrent mediastinal herniation of the fundoplication occurs in up to 45% of all initial antireflux surgery failure and accounts for the leading surgical technical cause of recurrent reflux symptoms, followed by varying degrees of wrap disruption or slippage and cruroplasty failure alone.¹⁰⁻¹²

Thus, evaluation of recurrent reflux symptoms after primary fundoplasty requires not only a thorough history and physical exam, but also appropriate diagnostic tests to obtain objective measures of reflux and postsurgical anatomy. This is especially important given that here is no obvious correlation between recurrent reflux symptoms and anatomical failure of index fundoplication.⁸ Diagnostic workup generally includes an esophagogastroduodenoscopy with pH monitoring, upper gastrointestinal series or equivalent contrast radiographic study, and esophageal manometry. Additionally, operative reports, imaging/objective data obtained prior to initial antireflux surgery, and chart review of events surrounding the index operation and presentation of recurrent symptoms is imperative. The combination of both allows for evaluation of whether the wrap was constructed incorrectly, has herniated, slipped, become disrupted, stenosed, or associated with a cruroplasty failure. A contrasted radiograph, such as an upper gastrointestinal study, is particularly high-yield given its ability to reveal an intrathoracic wrap, an overly tight fundoplication, or recurrence of hiatal hernia. This allows for real-time evaluation of liquid and tablet to identify physiology as well as symptom elucidation. Esophagogastroduodenoscopy allows for direct visualization of any evidence of esophagitis or sequelae of recurrent acid reflux, in addition to retroflexed views to ascertain wrap integrity, length, and tightness versus laxity. An upper endoscopy additionally enables objective measurement of reflux via pH monitoring, especially if appearance of esophageal mucosa and remainder of upper endoscopy is unremarkable. As mentioned above, missed diagnoses of other underlying etiology of acid reflux may be the ultimate culprit for fundoplication failure. To this end, an esophageal manometry serves useful to elucidate underlying esophageal dysmotility in addition to serving as a dynamic study interrogating wrap and hiatus tightness. Missed

diagnoses of gastroparesis and dysmotility may become worsened with a full fundoplication, resulting in food regurgitation, nausea, vomiting, and bloating symptoms. Typically, a gastric emptying study is warranted to further investigate the possibility of gastroparesis, the presence of which would require a different revisional algorithm than simply a re-fundoplication.

Considerations for Reoperative Antireflux Surgery

There are several considerations to be made prior to offering reoperative antireflux surgery once the above workup and evaluation has been completed. The decision is dependent on multiple factors, including etiology of primary fundoplication failure, patient risk profile, and operative approach to revisional surgery. Recurrent GERD post-fundoplication should likely undergo attempts at medical optimization, including medications such as antacid therapy, proton pump inhibitors, and prokinetics pending the patient's diagnosis. Previous observational and systemic review studies have demonstrated that the majority of refractory GERD cases are due to anatomic or surgical technical failures which for the most part resolve with good patient satisfaction after surgical revision of the wrap.^{5,8,11,12} This is particularly true given that diagnostic imaging completed in most cases of recurrent GERD identify intrathoracic migration of the previous wrap or slippage of stomach through the fundoplication; both causes that are unlikely to resolve with medical therapy alone. Symons et al completed a systematic review of 18 studies including 766 revisional antireflux surgeries which report 45% incidence of paraesophageal hernia and mediastinal migration of fundoplication, followed by 15% of cases with disrupted wrap and 12% of slipped wrap as etiology of antireflux surgery failure.¹² It is noteworthy to mention, however, that the presence of wrap herniation does not necessarily guarantee a recurrence of symptoms, suggesting that the incidence of herniation is higher than what is detected amongst symptomatic patients.^{11,12} Moreover, not all cases of herniated wraps demonstrate recurrent GERD symptoms severe enough to warrant a reoperation over medical therapy and lifestyle changes.

Though rarer, cases of esophageal dysmotility, gastroparesis, and even esophageal cancers misdiagnosed as acid reflux have led to instances where upper gastrointestinal symptoms have persisted despite a well-executed fundoplication. It is our institution's standard practice that patients undergo a full preoperative workup, including an esophagogastroduodenoscopy, contrasted radiograph study, and esophageal manometry, to avoid this pitfall prior to primary fundoplication especially in patients who endorse globus sensation, dysphagia,

odynophagia, bloating, and significant weight loss. In cases where patients have esophageal dysmotility, a conversion to a partial wrap such as a Dor or Toupet fundoplication may be appropriate over a redo Nissen fundoplication.¹³ Patients found to have delayed gastric emptying due to gastroparesis or connective tissue disorders such as scleroderma may benefit from a conversion to a roux-en-Y gastric bypass to address not only gastric dysmotility but also separation of parietal cells from contiguous proximity to the gastroesophageal junction to assist with reflux-related pain. Patients may alternatively be trialed with a surgical or endoscopic per-oral pyloroplasty in a staged approach to aid with dysmotility prior to or instead of pursuing surgical fundoplication revision or takedown.^{14,15}

Depending on the case series, patient satisfaction after revisional antireflux surgery remains high, up to 80% to 90%. However, a full discussion and conscientious decision-making is warranted given rates of up to 21% intraoperative and 16% postoperative complications after reoperative surgery. While there is a higher use of laparoscopic approach to revisional fundoplication, this has been associated with complication rates ranging between 4% and 32%. Given the increased amount of adhesive disease and perturbed anatomy, rates of conversion to open procedures are not inconsequential at around 3% to 10%. This is salient considering the higher rates of postoperative complications and 30-day mortality of up to 3% associated with open reoperative antireflux surgery. The more common complications after reoperative antireflux surgery include pneumothorax and pneumonia or respiratory insufficiency. While rarer in the order of 1% to 2% incidence, more devastating complications such as gastrointestinal leak due to missed esophageal or gastric injury may occur. Retrospective studies have additionally found various patient risk factors that escalate surgical failure, including larger hiatal hernia size, female gender, age greater than 50 years, chronic cough, and morbid obesity.¹⁶ More recent limited prospective studies demonstrate increased morbidity associated with serial repeat fundoplication surgeries for recalcitrant acid reflux, which can be mitigated by consideration for reconstructive Roux-en-Y diversion with durable clinical outcomes over revisional fundoplication.^{17,18} The ability to control modifiable lifestyle factors, such as obesity and medical comorbidities, in conjunction with maximized acid suppression medication may be advantageous over assuming the above risks inherent in reoperative surgery.

Risk stratification and surgical approach are important in patients with severe obesity. Obesity has been demonstrated as an independent risk factor predisposing one to primary antireflux surgery failure. Body mass indices of greater than 30 were positively correlated with

approximately 20% to 25% increased incidence of recurrent hiatal hernia and fundoplication disruption compared to non-obese patients.¹⁹ The mechanism behind this association remains unclear, but may be a compound effect of technical difficulty in executing a well-formed fundoplication in a patient with severe obesity, and also with the higher intra-abdominal pressure caused by increased central abdominal weight. The latter hypothesis is further underscored by our previous experiences where reflux resolution was achieved with concomitant hiatal hernia repair with longitudinal sleeve gastrectomy, but this effect was short-lived only while initial weight loss occurred.^{20,21} With weight plateau and/or regain, symptoms recurred suggesting that degree of obesity and patient weight have an intimate relationship with acid reflux pathophysiology. As is the current practice in our institution, Roux en-Y gastric bypass is the preferred procedure for antireflux purposes at index operation among patients with severe obesity and metabolic syndrome, rather than a revisional approach.²²

Other technical considerations may impact the proposed surgical approach to reoperative antireflux procedures. Generally speaking, early postoperative complications such as immediate fundoplication herniation are generally addressed via an abdominal approach with repeat laparoscopy. Typically, and specifically in our practice, chronic, later complications are approached via laparoscopy, but there may be specific advantages to thoracoscopy. This is to avoid substantial adhesive disease and re-approach antireflux surgery in a naïve plane with optimal exposure to native anatomy, though there is no data-proven superior approach. Retrospective reviews and case series demonstrate 55% to 80% of reoperative antireflux surgeries are completed laparoscopically, followed by 20% to 25% completed via an open abdominal approach, and the minority remainder of cases via thoracotomy or thoracoscopy.²³⁻²⁵ Data also suggest that with increased experience in revisional cases, an increasing number of operations are approached and completed laparoscopically. For many cases, a takedown of the pre-existing fundoplication is warranted to allow for either re-fundoplication or conversion to a partial wrap versus Roux-en-Y reconstruction. This allows for precise identification of the esophagus, esophago-gastric junction, and fundus. In instances of wrap disruption or slippage, repeat fundoplication is often reasonable pending fundus viability after dissection and preserved esophageal and gastric motility. Close examination of the hiatal crura is critical to determine the presence of a recurrent hernia which would require cruroplasty using sutures with or without pledgets depending on tissue quality. While also important during primary fundoplication and hiatal hernia repair, attaining complete mediastinal dissection of the distal esophagus to allow for at least 3 cm of tension-free intraabdominal

esophageal length is critical during reoperative cases to prevent another re-herniation. Determination of this length should occur without downward tension on the esophagus, to identify true distance. When necessary, a Collis or wedge gastropasty can be fashioned to ensure adequate esophageal length. In some instances where hiatal hernias are large and strength of crural repair is tenuous, some may elect to reinforce the repair using bio-absorbable mesh. The usage of prosthetic mesh is selective and case-specific, dependent on defect size, tissue attenuation, and tension across repair after satisfactory reapproximation. Additionally, select cases may warrant gastropexy sutures to not only anchor the stomach within the intraabdominal cavity, but also emphasize invagination of the distal esophagus within the fundus to restore the biomechanics of the Angle of His.²⁶ Lastly, esophagectomies are rare but a reserved last option usually applied in multiple reoperative cases where sequelae of previous surgeries make restoration of the gastroesophageal junction impossible and/or presence of significant esophageal damage from long-standing reflux, severe esophageal dysmotility, or lack of esophageal length that cannot be addressed using the maneuvers listed above. This may also be used in cases where intra-operative dissection has resulted in gastric or esophageal perforation, or ischemia from dissection in a severely scarred plane. Our experience has demonstrated the possible use of an esophagojejunostomy with Roux en-Y reconstruction in these scenarios but would be dependent on operator experience and patient factors on a case-by-case basis.²⁷

Future Directions

Management of recalcitrant upper gastrointestinal symptoms after primary antireflux surgery remains a challenging clinical conundrum not only due to difficulties related to accurate diagnosis but also significant operative considerations related to disease etiology, procedural risks, and technical factors. As with all disease processes, refractory GERD requires clinical acumen using appropriate diagnostic adjuncts and prudent decision-making to optimize patient outcome. Evidence demonstrates that reoperative surgery can be a highly satisfactory endeavor for an otherwise debilitating disease process. While outside the purview of this review, medical optimization remains a key step after primary antireflux surgery and a critical arbitrage opportunity to save patients from potential reoperative risk and complications. The field of benign foregut surgery is rapidly evolving, especially with the proliferation of robotic surgery and rise of surgical endoscopy and endoluminal procedures such as the transoral incisionless fundoplication (TIF).²⁸ While TIF is still under study, the durability of the procedure's antireflux effect has been questioned

given significant rates of wrap disruption diagnosed in post-procedural endoscopy.^{29,30} More relevant to this discussion, studies have shown longer operative times in surgical revision of failed TIF compared to failed surgical fundoplication due to a higher level of distorted native anatomy and more tedious dissection.²⁹ While TIF and other novel procedural approaches to revisional surgery is beyond the scope of this paper, we acknowledge that as the landscape of procedures for benign reflux disease evolves, conscientious evaluation for revisional surgery will continue to play a steadfast role in the successful management of GERD.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Grover BT, Kothari SN. Reoperative antireflux surgery. *Surg Clin N Am*. 2015;95(3):629-640. doi:10.1016/j.suc.2015.02.014
2. Richter JE, Rubenstein JH. Presentation and epidemiology of gastroesophageal reflux disease. *Gastroenterology*. 2018;154(2):267-276. doi:10.1053/j.gastro.2017.07.045
3. Dallemagne B, Kohnen L, Perretta S, Weerts J, Markiewicz S, Jehaes C. Laparoscopic repair of paraesophageal hernia. Long-term follow-up reveals good clinical outcome despite high radiological recurrence rate. *Ann Surg*. 2011;253(2):291-296. doi:10.1097/SLA.0b013e3181ff44c0
4. Dallemagne B, Weerts J, Markiewicz S, et al. Clinical results of laparoscopic fundoplication at ten years after surgery. *Surg Endosc*. 2006;20(1):159-165. doi:10.1007/s00464-005-0174-x
5. Hu Y, Ezekian B, Wells KM, et al. Long-term satisfaction and medication dependence after antireflux surgery. *Ann Thorac Surg*. 2013;96(4):1246-1251. doi:10.1016/j.athoracsur.2013.05.017
6. Dowgiało-Gornowicz N, Kacperczyk J, Masiewicz A, et al. Patient satisfaction after laparoscopic Nissen fundoplication-long-term outcomes of single-center study. *J Clin Med*. 2021;10(24):5924. doi:10.3390/jcm10245924
7. van Beek DB, Auyang ED, Soper NJ. A comprehensive review of laparoscopic redo fundoplication. *Surg Endosc*. 2011;25(3):706-712. doi:10.1007/s00464-010-1254-0
8. Dallemagne B, Arenas Sanchez M, Francart D, et al. Long-term results after laparoscopic reoperation for failed antireflux procedures. *Br J Surg*. 2011;98(11):1581-1587. doi:10.1002/bjs.7590
9. Antiporda M, Jackson C, Smith CD, Thomas M, Elli EF, Bowers SP. Strategies for surgical remediation of

- the multi-fundoplication failure patient. *Surg Endosc.* 2019;33(5):1474-1481. doi:10.1007/s00464-018-6429-0
10. Furnée EJ, Draaisma WA, Broeders IA, Gooszen HG. Surgical reintervention after failed antireflux surgery: a systematic review of the literature. *J Gastrointest Surg.* 2009;13(8):1539-1549. doi:10.1007/s11605-009-0873-z
 11. Chukwumah CV, Ponsky JL. Revisional surgery for failed antireflux surgery. *Surg Laparosc Endosc Percutan Tech.* 2010;20(5):326-331. doi:10.1097/SLE.0b013e3181f39fc4
 12. Symons NR, Purkayastha S, Dillemans B, et al. Laparoscopic revision of failed antireflux surgery: a systematic review. *Am J Surg.* 2011;202(3):336-343. doi:10.1016/j.amjsurg.2011.03.006
 13. Broeders JA, Mauritz FA, Ahmed Ali U, et al. Systematic review and meta-analysis of laparoscopic Nissen (posterior total) versus Toupet (posterior partial) fundoplication for gastro-oesophageal reflux disease. *Br J Surg.* 2010;97(9):1318-1330. doi:10.1002/bjs.7174
 14. Rodriguez J, Strong AT, Haskins IN, et al. Per-oral pyloromyotomy (POP) for medically refractory gastroparesis: short term results from the first 100 patients at a high volume center. *Ann Surg.* 2018;268(3):421-430. doi:10.1097/SLA.0000000000002927
 15. Landreneau JP, Strong AT, El-Hayek K, et al. Laparoscopic pyloroplasty versus endoscopic per-oral pyloromyotomy for the treatment of gastroparesis. *Surg Endosc.* 2019;33(3):773-781. doi:10.1007/s00464-018-6342-6
 16. Morgenthal CB, Lin E, Shane MD, Hunter JG, Smith CD. Who will fail laparoscopic Nissen fundoplication? Preoperative prediction of long-term outcomes. *Surg Endosc.* 2007;21(11):1978-1984. doi:10.1007/s00464-007-9490-7
 17. Giulini L, Razia D, Mittal SK. Redo fundoplication and early Roux-en-Y diversion for failed fundoplication: a 3-year single-center experience. *Surg Endosc.* 2022;36(5):3094-3099. doi:10.1007/s00464-021-08610-y
 18. Shao JM, Elhage SA, Prasad T, et al. Best reoperative strategy for failed fundoplication: redo fundoplication or conversion to Roux-en-Y gastric diversion? *Surg Endosc.* 2021;35(7):3865-3873. doi:10.1007/s00464-020-07800-4
 19. Akimoto S, Nandipati KC, Kapoor H, Yamamoto SR, Pallati PK, Mittal SK. Association of Body Mass Index (BMI) with patterns of fundoplication failure: Insights gained. *J Gastrointest Surg.* 2015;19(11):1943-1948. doi:10.1007/s11605-015-2907-z
 20. Davis M, Rodriguez J, El-Hayek K, et al. Paraesophageal hernia repair with partial longitudinal gastrectomy in obese patients. *JLS.* 2015;19(3):e2015.00060. doi:10.4293/JLS.2015.00060
 21. Rodriguez JH, Kroh M, El-Hayek K, Timratana P, Chand B. Combined paraesophageal hernia repair and partial longitudinal gastrectomy in obese patients with symptomatic paraesophageal hernias. *Surg Endosc.* 2012;26(12):3382-3390. doi:10.1007/s00464-012-2347-8
 22. Obeid NR, Altieri MS, Yang J, et al. Patterns of reoperation after failed fundoplication: an analysis of 9462 patients. *Surg Endosc.* 2018;32(1):345-350. doi:10.1007/s00464-017-5682-y
 23. Banki F, Kaushik C, Roife D, Chawla M, Casimir R, Miller CC. Laparoscopic reoperative antireflux surgery: A safe procedure with high patient satisfaction and low morbidity. *Am J Surg.* 2016;212(6):1115-1120. doi:10.1016/j.amjsurg.2016.09.011
 24. Banki F, Weaver M, Roife D, et al. Laparoscopic reoperative antireflux surgery is more cost-effective than open approach. *J Am Coll Surg.* 2017;225(2):235-242. doi:10.1016/j.jamcollsurg.2017.03.019
 25. Munie S, Nasser H, Gould JC. Salvage options for fundoplication failure. *Curr Gastroenterol Rep.* 2019;21(9):41. doi:10.1007/s11894-019-0709-2
 26. Nissen R. Gastropexy and "fundoplication" in surgical treatment of hiatal hernia. *Am J Dig Dis.* 1961;6:954-961. doi:10.1007/BF02231426
 27. Takahashi H, Allemang MT, Strong AT, et al. Completion gastrectomy with esophagojejunostomy for management of complications of benign foregut surgery. *J Laparoendosc Adv Surg Tech A.* 2018;28(8):983-989. doi:10.1089/lap.2017.0540
 28. Cadière GB, Buset M, Muls V, et al. Antireflux transoral incisionless fundoplication using EsophyX: 12-month results of a prospective multicenter study. *World J Surg.* 2008;32(8):1676-1688. doi:10.1007/s00268-008-9594-9
 29. Witteman BP, Kessing BF, Snijders G, Koek GH, Conchillo JM, Bouvy ND. Revisional laparoscopic antireflux surgery after unsuccessful endoscopic fundoplication. *Surg Endosc.* 2013;27(6):2231-2236. doi:10.1007/s00464-012-2685-6
 30. Nieponice A, Jobe BA. Endoscopic fundoplication: real or fantasy? *J Gastrointest Surg.* 2011;15(8):1295-1298. doi:10.1007/s11605-011-1580-0