

Surgical Management of Gastroesophageal Reflux Disease: Patient Selection, Fundoplication, And Emerging Antireflux Strategies

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ABSTRACT

Gastroesophageal reflux disease is a chronic condition caused by failure of the antireflux barrier at the esophagogastric junction. Surgical management aims to restore this barrier by improving the function of the diaphragmatic crura, lower esophageal sphincter, and gastroesophageal flap valve. Laparoscopic Nissen fundoplication remains the reference operation for durable reflux control, although partial fundoplications and newer antireflux technologies have expanded treatment options. Antireflux surgery may provide better short-term quality of life than proton pump inhibitor therapy in selected patients, and long-term series report durable symptom control after fundoplication. However, postoperative proton pump inhibitor use, dysphagia, gas-bloat syndrome, wrap failure, and need for reoperation remain clinically relevant. The best outcomes depend on objective confirmation of reflux, appropriate symptom correlation, careful evaluation of esophageal motility, and tailored procedure selection. Partial fundoplication may reduce dysphagia and gas-bloat symptoms but can be associated with higher postoperative acid-suppression use. Magnetic sphincter augmentation and other emerging techniques may offer less disruptive alternatives in selected patients, although long-term comparative evidence continues to evolve. This review summarizes the contemporary surgical management of gastroesophageal reflux disease, emphasizing preoperative workup, operative selection, expected outcomes, complications, and special populations.

KEYWORDS: gastroesophageal reflux disease; antireflux surgery; Nissen fundoplication; Toupet fundoplication; magnetic sphincter augmentation; hiatal hernia; lower esophageal sphincter.

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INTRODUCTION

Gastroesophageal reflux disease occurs when gastric contents reflux into the esophagus and produce troublesome symptoms, mucosal injury, or extraesophageal manifestations. Although proton pump inhibitors remain the dominant medical treatment, acid suppression does not correct the mechanical defect at the esophagogastric junction and does not eliminate nonacid reflux. Antireflux surgery addresses this limitation by reconstructing the natural barrier formed by the lower esophageal sphincter, the diaphragmatic crura, and the gastroesophageal flap valve [1–3]. Surgery should not be considered merely a last resort after medical failure. In appropriately selected patients with

objectively confirmed reflux, antireflux surgery can provide durable symptom control, reduce reflux exposure, and improve quality of life. The challenge is not whether surgery works, but which patient benefits, which operation best matches the anatomy and physiology, and how to minimize postoperative side effects [4,5].

Patient Selection and Preoperative Evaluation

Patient selection is the cornerstone of successful antireflux surgery. Symptoms alone are insufficient because heartburn, regurgitation, chest discomfort, cough, and throat symptoms may arise from non-reflux causes. Surgery should be offered only when there is convincing evidence that reflux is responsible for the patient's symptoms. Objective evaluation

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typically includes upper endoscopy, ambulatory pH or pH-impedance monitoring, esophageal manometry, and contrast swallow when hiatal hernia or altered anatomy is suspected [2,6].

Endoscopy identifies erosive esophagitis, Barrett's esophagus, peptic stricture, hiatal hernia, and alternative diagnoses. Ambulatory reflux monitoring confirms abnormal acid exposure and helps correlate symptoms with reflux events, particularly in patients without severe erosive esophagitis. Manometry is essential before surgery because it excludes major motility disorders and guides the choice between total and partial fundoplication. A barium swallow helps define hiatal hernia size, esophageal shortening, obstruction, or recurrent anatomy in revision cases.

The best surgical candidates are patients with typical reflux symptoms, objective abnormal reflux, good symptom correlation, and anatomy suitable for reconstruction. Poor outcomes are more likely when symptoms are functional, weakly associated with reflux, dominated by bloating or nausea, or when reflux testing is normal [7].

Principles of Antireflux Surgery

Antireflux surgery restores the esophagogastric junction by reducing any hiatal hernia, mobilizing the distal esophagus, achieving adequate intra-abdominal esophageal length, approximating the diaphragmatic crura, and reinforcing the lower esophageal sphincter mechanism with a fundic wrap or device-based augmentation. Fundoplication is effective because it controls both acid and nonacid reflux, unlike proton pump inhibitors, which suppress acidity but do not prevent reflux events [7].

The operation must balance reflux control against obstructive side effects. A wrap that is too tight, too long, twisted, or placed around an inadequately mobilized esophagus can cause dysphagia, chest discomfort, gas-bloat syndrome, or inability to belch. Conversely, an overly loose repair or inadequate hiatal closure may lead to recurrent reflux or wrap herniation. Technical precision and patient-specific tailoring are therefore central to durable success.

Nissen Fundoplication

The 360-degree Nissen fundoplication remains the classic and most established antireflux procedure. It provides strong reflux control and produces the greatest objective improvement in acid exposure and DeMeester score in many comparative studies [8]. Long-term series have reported durable benefit, with approximately 80% success at 20 years and high patient satisfaction in well-selected cohorts [9,10]. The main disadvantage of Nissen fundoplication is its side-effect profile. Total fundoplication may increase postoperative dysphagia, gas-bloat syndrome, inability to belch, and bloating. These symptoms are often transient but may persist in some patients and occasionally require dilation or revision. Nissen fundoplication is generally favored in patients with preserved esophageal motility, typical GERD symptoms, severe erosive esophagitis, or Barrett's esophagus when complete reflux control is prioritized [4,8].

Partial Fundoplication

Partial fundoplications were developed to reduce the obstructive side effects associated with a complete wrap. The posterior 270-degree Toupet fundoplication and anterior Dor fundoplication provide reinforcement of the gastroesophageal junction while allowing less resistance to bolus transit and venting.

Comparative evidence suggests that partial and complete fundoplications can provide similar long-term symptom control, while partial wraps often reduce gas-bloat symptoms, postoperative dysphagia, and reoperation for obstructive complaints [6,8]. However, partial fundoplication may be associated with greater postoperative or prolonged proton pump inhibitor use, suggesting a possible tradeoff between side-effect reduction and maximal reflux suppression [6].

Partial fundoplication is particularly attractive in patients with impaired esophageal peristalsis or reduced peristaltic reserve. Impaired motility is not an absolute contraindication to antireflux surgery, but it should influence the choice and calibration of the wrap [7,11].

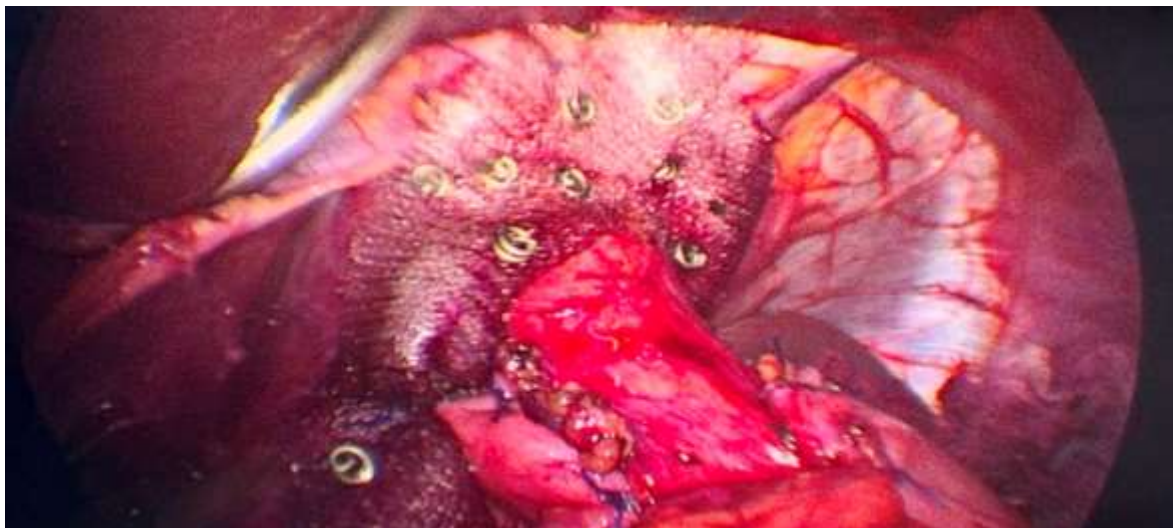


Figure 1. Type III hiatus, mesh and toupet

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Magnetic Sphincter Augmentation and Newer Technologies
Magnetic sphincter augmentation, commonly represented by the LINX device, reinforces the lower esophageal sphincter using a ring of magnetic beads placed around the gastroesophageal junction. The device is designed to resist reflux while opening during swallowing. It is less anatomically disruptive than fundoplication and may preserve belching and vomiting better in selected patients.

Available evidence suggests that magnetic sphincter augmentation can improve reflux symptoms and may have a favorable side-effect profile in selected patients, including some with atypical symptoms [1,8]. However, careful selection remains essential, and long-term durability, device-related complications, dysphagia, erosion, and need for removal must be considered.

Other emerging strategies, including RefluxStop, aim to restore the gastroesophageal flap valve and reduce reflux without creating a tight circumferential wrap. Early results appear promising, but the evidence remains preliminary compared with conventional fundoplication [1,4].

Surgical Versus Medical Management

Medical therapy with proton pump inhibitors is effective for many patients, but it does not correct the underlying mechanical defect, and a substantial proportion of treated patients remain symptomatic. In the uploaded synthesis, up to 40% of PPI-treated patients remain symptomatic, while approximately 28% of patients continue PPI use after surgery, emphasizing that neither approach is perfect.

A systematic review and meta-analysis found that antireflux surgery provided superior short-term quality of life compared with PPI therapy, although short-term symptom control was not significantly better in all analyses [6]. The SAGES guideline panel conditionally recommended surgical treatment over medical management for adults with chronic or chronic refractory GERD, but the certainty of evidence was low to moderate [5]. This means that surgery is a strong option for selected patients, but shared decision-making is essential.

Complications and Failure

Postoperative symptoms and structural failure remain important limitations. Dysphagia may result from edema, tight fundoplication, poor motility, wrap migration, or unrecognized obstruction. Gas-bloat syndrome may produce fullness, inability to belch, flatulence, and postprandial discomfort. Other complications include wrap disruption, slippage, paraesophageal herniation, recurrent hiatal hernia, recurrent reflux, chest pain, diarrhea, and need for revisional surgery.

The source document reports that up to 30% of patients may develop structural complications after laparoscopic antireflux surgery, including wrap disruption, herniation, or slippage, and approximately 5–10% may require a second procedure. Revision surgery is more complex than primary surgery

because of adhesions, altered anatomy, distorted hiatus, and higher risk of esophageal or gastric injury.

Failure should be evaluated anatomically and physiologically rather than treated empirically. Endoscopy, pH monitoring, manometry, and contrast swallow are used to distinguish recurrent reflux from dysphagia caused by obstruction, functional symptoms, or non-reflux disorders.

Special Populations

In pediatric patients, the evidence base is weaker and more heterogeneous. Fundoplication may be used for severe GERD, neurologic impairment, aspiration risk, or failure of medical therapy, but systematic review evidence does not clearly show reduction in hospitalizations for aspiration pneumonia, apnea, or reflux-related symptoms [12]. Recurrence appears to be below 20% in some pediatric series, but patient heterogeneity limits firm conclusions.

After esophageal atresia repair, GERD is common and difficult to manage. Antireflux surgery may fail in a significant proportion, with reported failure rates ranging widely. Long-gap esophageal atresia, prior abdominal surgery, and patient-specific anatomical factors increase complexity [13].

GERD after sleeve gastrectomy is another important subgroup. In patients with refractory reflux after sleeve gastrectomy, Roux-en-Y gastric bypass is generally the most effective revisional operation, while magnetic sphincter augmentation may be considered in selected patients as a less invasive alternative [14].

Systemic sclerosis represents a particularly difficult scenario because reflux may coexist with severe esophageal dysmotility. Fundoplication can reduce symptoms in selected patients, but postoperative dysphagia is a major concern and the quality of evidence is limited [15].

Discussion

Modern antireflux surgery is moving from a one-procedure model toward individualized reconstruction of the esophagogastric junction. Nissen fundoplication remains the reference operation for strong reflux control, but partial fundoplication, magnetic sphincter augmentation, and newer techniques reflect the need to reduce dysphagia, gas-bloat, and functional side effects.

The most important determinant of success is not the operation alone, but the match between patient, physiology, anatomy, and technique. A patient with classic regurgitation, abnormal reflux monitoring, a hiatal hernia, and preserved motility is very different from a patient with normal reflux testing and extraesophageal symptoms. Similarly, patients with weak peristalsis, post-sleeve anatomy, systemic sclerosis, or prior esophageal atresia repair require modified expectations and individualized planning.

The strongest surgical rationale is that fundoplication and related procedures restore the barrier and reduce reflux events, including nonacid reflux. The strongest caution is that postoperative symptoms and structural failure remain real.

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Therefore, antireflux surgery should be performed after complete evaluation, with clear counseling about benefits, alternatives, side effects, and the possibility of continued medication or revision.

Table 1. Compact Comparison of Surgical Options for GERD

Procedure	Main advantage	Main limitation	Best suited for
Nissen fundoplication	Strongest reflux control and most established long-term data	Higher dysphagia and gas-bloat risk	Typical GERD with preserved motility, severe esophagitis, Barrett’s in selected patients
Toupet fundoplication	Less dysphagia and gas-bloat	Possibly higher prolonged PPI use	GERD with impaired or borderline esophageal motility
Dor fundoplication	Lower obstructive effect, useful in selected contexts	May provide less reflux control than complete wrap	Selected patients needing anterior partial reinforcement
Magnetic sphincter augmentation	Less anatomical disruption and preserved belching in selected patients	Device-related risks and need for careful selection	Confirmed GERD without major motility disorder or complex anatomy
RefluxStop / emerging flap-valve strategies	Promising early symptom control with fewer side effects	Preliminary evidence and limited long-term data	Selected patients in experienced centers or investigational contexts
Roux-en-Y gastric bypass	Strong revisional option after sleeve-related refractory GERD	Major revisional bariatric operation	Refractory GERD after sleeve gastrectomy

CONCLUSION

Surgical management of gastroesophageal reflux disease is effective when applied to carefully selected patients with objectively confirmed reflux. Laparoscopic Nissen fundoplication remains the gold-standard procedure for durable reflux control, while partial fundoplications offer similar symptom control in many patients with fewer obstructive side effects but possibly greater postoperative PPI use. Magnetic sphincter augmentation and newer technologies may benefit selected patients, although long-term comparative evidence remains less mature. Preoperative evaluation with endoscopy, reflux monitoring, manometry, and anatomical imaging is essential to confirm diagnosis and guide operative choice. The future of GERD surgery lies in personalized restoration of the esophagogastric junction rather than uniform application of a single antireflux procedure.

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