

# Does Gastric Resection Have a Role in the Management of Severe Postfundoplication Gastric Dysfunction?

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## Abstract

**Background** Bloating, flatulence, early satiety, and dysphagia resolve in more than 90% of patients early after fundoplication. Gastric dysfunction can persist, however, and a small number of patients develop severe gastric dysfunction (gastroparesis). Management of gastroparesis after antireflux procedures is generally conservative, but gastroparesis can become refractory to medical therapy. The aim of this study was to assess the role of gastric resection in the management of the unusual patient with severe postfundoplication gastric dysfunction.

**Methods** From January 1990 to October 2010, a total of 5,129 gastric resections were performed at our institution. From this cohort, we identified nine patients with postfundoplication gastric dysfunction managed with gastric resection. Clinical records were reviewed retrospectively for preoperative evaluation, perioperative course, and long-term outcomes.

**Results** Over 20 years, nine patients were treated with gastric resection for debilitating gastric dysfunction after antireflux surgery. Seven of the nine patients were female; the median preoperative body mass index was 25 kg/m<sup>2</sup> (18–31 kg/m<sup>2</sup>). Median follow-up was 23 months

(1–97 months). Preoperatively, five patients required enteral feeding. Postoperatively, although there were no deaths, one patient required operative drainage of a subphrenic abscess, one developed temporary respiratory failure, and one was readmitted for partial small bowel obstruction. Six of the nine patients maintain their nutrition orally, but three are maintained with enteral nutrition. Only two patients are subjectively asymptomatic.

**Conclusions** Outcomes after gastric resection for postfundoplication gastric dysfunction are poor, with three of the nine patients requiring supplemental nutrition and seven of the nine having persistent symptoms.

## Introduction

With the introduction of laparoscopic Nissen fundoplication in 1991, we have witnessed a dramatic increase in the annual number of antireflux procedures performed in the United States: from 6.6 per 100,000 in 1994 to 11.0 per 100,000 persons in 2003 [1–3]. Although long-term outcomes indicate that fundoplication is effective in most patients, 30% of those who undergo a Nissen fundoplication develop recurrent symptoms [4–6]. Dysphagia and gas-bloat syndrome, well recognized symptoms early after fundoplication [7–10], generally resolve during the first 3 months and are uncommon after 1 year. Unfortunately, in rare instances, patients develop refractory symptoms of bloating, nausea, and vomiting secondary to gastric dysfunction (gastroparesis).

Symptoms of gastric dysfunction may have been present prior to the original fundoplication, causing gastroesophageal reflux, but were noticed only postoperatively. More likely, though, the gastric dysfunction resulted from vagal injury at the time of the fundoplication [11, 12]. Regardless

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of the pathogenesis of postfundoplication gastric dysfunction, management of this rare complication is challenging and poorly defined. At our tertiary referral center with a defined expertise in gastrointestinal dysmotility syndromes, these patients have come under our care and have been approached similarly to patients with postvagotomy gastric stasis. In selected, highly symptomatic patients, near-total completion gastrectomy has been an effective approach to managing postvagotomy gastric stasis but is associated with a postoperative morbidity rate approaching 40% [13, 14]. The aim of the current study was to evaluate the role of gastric resection in the management of the subpopulation of postfundoplication gastric dysfunction with debilitating symptoms refractory to medical management.

## Methods

The Mayo Clinic Institutional Review Board approved this retrospective study. Clinical and financial records at Mayo Clinic (Rochester, MN) from January 1990 to October 2010 were examined to identify a cohort of 5,129 patients who underwent partial or total gastrectomy. Patients treated with gastric resection for ulcer disease ( $n = 1,004$ ), a benign lesion or bleeding ( $n = 792$ ), or malignancy ( $n = 1,741$ ) were excluded from the study. We then identified the subgroup of patients who had a history of an antireflux procedure ( $n = 106$ ). From this cohort, we reviewed the medical records to identify all patients over the age of 18 who underwent gastric resection to manage postfundoplication gastric dysfunction. The diagnosis of postfundoplication gastric dysfunction was based on a clinical diagnosis and included a history of bloating, nausea, vomiting of food ingested more than 3 hours previously, regurgitation, and/or other features consistent with gastric dysmotility. This clinical diagnosis was supported by objective evidence, such as a solid food gastric emptying study, but was not required for inclusion in this study. Not all patients underwent a formal gastric emptying study when symptoms of gastroparesis were evident (e.g., vomiting of food eaten the previous day or solid food in the stomach on endoscopy after an appropriate fast).

Nine patients met the inclusion criteria for this study. All underwent gastric resection for management of the postfundoplication gastric dysfunction at Mayo Clinic (Rochester, MN). The index antireflux procedure was performed at Mayo Clinic ( $n = 1$ ) or at another institution ( $n = 8$ ). Consideration for gastric resection required failure of medical management and preoperative evaluation by a multidisciplinary team, including a gastroenterologist, psychiatrist, dietitian, and surgeon.

Patients' medical records were reviewed for demographic information, date of initial antireflux procedure,

symptoms, previous operations, co-morbidities, intraoperative data, duration of hospital stay after gastrectomy, and postoperative complications. Previous medical and operative attempts at managing postfundoplication gastric dysfunction were abstracted from the clinical record using operative reports, biopsy results (evidence of Barrett's esophagitis), endoscopic interventions, imaging studies, and manometry. Postoperative complications and readmissions were limited to 30 days after the operative procedure. Complication severity was defined by the Dindo-Clavien grading system [15].

Follow-up was based on the most recent communication between the patient and the treating physician at Mayo Clinic. Outcomes at follow-up were based on retrospective review of clinical records and included date of last follow-up, operative or endoscopic interventions, need for enteral or parenteral nutrition, weight, and nutritional status based on the most recent serum albumin concentration.

## Results

Over 20 years, nine patients were treated by gastric resection (four total gastrectomies with Roux-en-Y esophagojejunostomy, two near-total gastrectomies with gastrojejunostomy, two proximal gastrectomies with esophagojejunostomy, and one combined esophagectomy and proximal gastrectomy) for gastric dysfunction after fundoplication. All procedures were performed in an open fashion using a midline incision ( $n = 7$ ), left thoracoabdominal approach ( $n = 1$ ), or combined midline and right thoracotomy ( $n = 1$ ). Diagnosis of postfundoplication gastroparesis was supported by endoscopic evidence of retained food in the stomach after overnight fasting for five patients and abnormal gastric emptying study in two patients. For two patients, the diagnosis of gastroparesis was based on clinical assessment and outside records. Patient characteristics are outlined in Table 1.

The index antireflux procedure included laparoscopic Nissen fundoplication in six patients, open Nissen fundoplication in two patients, and Belsey (transthoracic) fundoplication in one patient. Most of the patients were female (78%) with a median body mass index (BMI) of 24.6 kg/m<sup>2</sup>. The median preoperative serum albumin concentration was 4.5 g/dl (2.9–4.7 g/dl). The median duration of symptoms prior to the index fundoplication was 5 years (2–30 years). At the time of presentation for management of postfundoplication gastric dysfunction, dominant symptoms were dysphagia ( $n = 2$ ), early satiety and bloating ( $n = 2$ ), bile reflux ( $n = 2$ ), dumping syndrome ( $n = 2$ ), and recurrent aspiration pneumonia ( $n = 1$ ). Preoperatively, five patients were receiving enteral feeding. No patients required preoperative parenteral nutrition. Prokinetic medications were

**Table 1** Patients' characteristics ( $n = 9$ )

Variable	No. <sup>a</sup>
Female	7
BMI at gastric resection (kg/m <sup>2</sup> ), median (range)	24.6 (18.3–30.5)
Preoperative medication use	
Narcotics	5
Benzodiazapines	4
SSRI	1
Tricyclic antidepressants	1
Co-morbidities <sup>b</sup>	
COPD	1
History of smoking	5
Alcohol abuse	1
Hiatal hernia	2
Obesity	2
ASA physical status classification, median	3
Charlson comorbidity index, median	0

BMI body mass index, ASA American Society of Anesthesiologists, SSRI selective serotonin reuptake inhibitor, COPD chronic obstructive pulmonary disease

<sup>a</sup> Unless otherwise stated for a particular variable

<sup>b</sup> No history of diabetes mellitus, coronary artery disease, scleroderma, or achalasia

used preoperatively in five patients without alleviation of symptoms. Two patients had “failed” medical therapy prior to referral; specific prokinetic agents were not documented. Two patients had concomitant diarrhea, and therefore prokinetic medications were not used. Five patients were on narcotic medications prior to operative intervention.

Five patients had a history of esophageal dilation without symptom alleviation. Eight of nine patients had one or more operations to address symptoms of gastric dysfunction prior to gastric resection. Previous operative interventions are outlined in Table 2. Five patients underwent gastric emptying studies (<sup>99m</sup>Tc-sulfur colloid labeled meal), and two were subjected to esophageal manometry prior to gastric resection. Gastric emptying was abnormal in two of the five patients studied. No patients were found to have abnormal esophageal motility suggestive of achalasia, scleroderma, Nutcracker esophagus, or diffuse esophageal spasm. Three patients underwent sham feeding studies with measurement of pancreatic polypeptide (PP). All three patients failed to have an increase in serum PP levels, indicating abnormal vagus nerve function.

The median operating time for gastric resection to manage postfundoplication gastric dysfunction was 463 min (187–625 min); the median estimated blood loss (EBL) was 300 ml (50–2,050 ml). Two patients required intraoperative blood transfusion. A feeding jejunostomy was placed in six patients. No intraoperative complications were noted.

Postoperatively, three patients had complications. The median duration of stay was 10 days (7–32 days). Two patients had complications during the initial hospitalization. One patient developed a subphrenic abscess requiring reoperation and drainage (Dindo-Clavien grade IIIb); no anastomotic leak was identified at reoperation to explain the infection. This same patient also developed a vascular catheter-associated infection and endocarditis requiring mitral valve repair 4 months after her initial operation. A second patient developed pneumonia requiring transfer to the intensive care unit and reintubation early during the hospital course (Dindo-Clavien grade IVa). One patient was readmitted within the first 30 days after operation for partial small bowel obstruction (Dindo-Clavien grade II) that resolved with conservative management. No deaths occurred during the median follow-up of 23 months (1–97 months).

During the follow-up, seven of the nine patients continue to have persistent symptoms with one patient having symptoms severe enough to interfere with daily activity. Two patients are subjectively asymptomatic. Eight reported weight loss after their operation; the median weight loss was 7 kg (0–29 kg) at the most recent follow-up. The median serum albumin concentration (3.9 g/dl) remained in the normal reference range (3.5–5.0 g/dl). One patient who underwent esophagogastrectomy required a duodenal switch procedure to manage refractory bile reflux. Three patients required temporary parenteral nutrition postoperatively. Four patients required enteral feeding postoperatively, three of whom remain on enteral nutrition per feeding tube. Patients who did not require preoperative supplemental enteral nutrition have not required long-term enteral or parenteral nutritional support. All patients are currently living at home and have not required long-term nursing care.

## Discussion

Postvagotomy/postgastrectomy gastric dysfunction (gastroparesis) is a well recognized but rare complication of gastric surgery [10]. Previous reports describing attempts at operative management of this disorder have described variable long-term results and morbidity [13]. These previous studies have focused primarily on patients who developed gastric dysmotility as a result of deliberate vagotomy usually accompanied by gastric resection. In this study, we describe our experience with a unique subgroup of patients who underwent a fundoplication procedure to manage antireflux disease and postoperatively developed symptoms consistent with vagal injury. Our experience with operative management of this disorder by gastrectomy has been disappointing, with most of the patients

**Table 2** Individual patient operative history and clinical outcomes ( $n = 9$ )

Age (years)	Previous operations	Type of gastric resection	Preoperative supplemental nutrition <sup>a</sup>	Postoperative supplement nutrition	Postoperative complication or readmission <sup>b</sup>	Persistent symptoms	Follow-up (months)
42	(1) Belsey fundoplication (2) Takedown of Belsey, revision fundoplication (3) Proximal gastrectomy and jejunal interposition	Total gastrectomy with Roux-en-Y esophagojejunostomy	No	No	No	Yes	97
47	(1) Laparoscopic Nissen fundoplication (2) Takedown of Nissen, closure of hiatal hernia, revision fundoplication (3) Open pyloroplasty	Near-total gastrectomy with Roux-en-Y gastrojejunostomy	Yes	Yes	No	Yes	23
49	(1) Laparoscopic Nissen fundoplication (2) Laparoscopic takedown of Nissen, repair of hiatal hernia, fundus resection, and Roux-en-Y gastrojejunostomy	Proximal gastrectomy with Roux-en-Y esophagojejunostomy	Yes	Yes	No	Yes	16
50	(1) Laparoscopic Nissen fundoplication (2) Revision Nissen, antrectomy, Roux-en-Y Gastrojejunostomy	Total gastrectomy with Roux-en-Y esophagojejunostomy	No	No	Yes	Yes	7
52	(1) Laparoscopic Nissen fundoplication (2) Takedown of Nissen, revision partial fundoplication (3) Takedown of partial fundoplication	Proximal gastrectomy with Roux-en-Y esophagojejunostomy	No	No	Yes	Yes	27
52	(1) Laparoscopic Nissen fundoplication (2) Takedown of Nissen, revision partial fundoplication	Distal esophagectomy and proximal gastrectomy with esophagogastrostomy (Ivor-Lewis)	Yes	Yes	Yes	Yes	33
61	(1) Laparoscopic Nissen fundoplication	Near-total gastrectomy with Roux-en-Y Gastrojejunostomy	Yes	No	No	Yes	66
65	(1) Open Nissen fundoplication (2) Hill gastropexy and repair of hiatal hernia (3) Partial gastrectomy with Billroth I	Total gastrectomy with Roux-en-Y esophagojejunostomy	No	No	No	No	4
73	(1) Open Nissen fundoplication (2) Takedown of Nissen, revision fundoplication (3) Takedown of revision Nissen, revision partial fundoplication (4) Belsey fundoplication	Near-total gastrectomy with Roux-en-Y gastrojejunostomy	Yes	No	No	No	1

<sup>a</sup> No patients had a history of parenteral nutrition preoperatively

<sup>b</sup> Within the 30 days after the gastric resection operation

continuing to have persistent symptoms. Equally worrisome is that three of the patients still require nutritional support at a median follow-up of 23 months.

The decision and planning of operative intervention for postfundoplication gastric dysfunction is distinctly different from revisional surgery for “failed” Nissen fundoplication. In the era of laparoscopic Nissen fundoplication, numerous groups have studied their outcomes after repeat or redo fundoplication. In a literature review of redo fundoplication by van Beek and colleagues [6], most of the operations (59%) were performed for recurrent gastroesophageal reflux disease, with the two most common causes for failure being recurrent hiatal hernia (44%) and breakdown of the fundoplication (16%). The success of these operations was reported to be 65–100%. It is likely that a fraction of these revisional operations included patients with postfundoplication gastric dysfunction, but these investigators did not describe this subgroup specifically.

In a systematic review of surgical reintervention after failed antireflux surgery, Furnée et al. [16] found that approximately 2% of patients had an intervention because of a motility disorder or error in the initial diagnosis. Lamb et al. [17] reported 109 patients who underwent reoperation for symptoms after fundoplication; only one (1%) had delayed gastric emptying. In a similar report, Khajanchee et al. [18] performed 176 laparoscopic reinterventions for failed antireflux surgery; in their series, 17 patients with gastric dysmotility were managed with subtotal gastrectomy ( $n = 6$ ), pyloroplasty ( $n = 10$ ), or Roux-en-Y gastrojejunostomy ( $n = 1$ ). Unfortunately, outcomes for this subgroup of patients were not described.

Williams et al. [19] compared redo fundoplication ( $n = 25$ ) with gastrectomy ( $n = 12$ ) for treatment of failed antireflux procedure and found that gastrectomy patients were more likely to have complete relief of their primary symptom (89 vs. 50%). The postoperative complication rate was high in the gastrectomy group (67%) compared to redo-fundoplication (20%). Although Williams et al. concluded that redo fundoplication should be avoided in patients with severe gastroparesis, their study did not address specifically the outcomes of reoperation in this subgroup of patients.

Several studies have investigated the role of gastric resection in postvagotomy/postgastrectomy gastroparesis [13, 14, 20–23]. In 1999, we reported our outcomes for this disorder in 62 patients who were managed by near-total completion gastrectomy [13]. Postoperative complications occurred in 40% of patients, and only 43% noted marked alleviation of symptoms [13]. In a recent series by Speicher et al., 44 patients underwent completion gastrectomy for postoperative gastroparesis, 9 of whom had a history of Nissen fundoplication; 36% of the patients had at least one

complication [14]. Most of the patients (78%) reported better health, with only 6% having worse health after operative intervention. Similar to our experience with gastrectomy for incapacitating gastric dysfunction after fundoplication, gastric resection for postvagotomy gastroparesis has a high postoperative morbidity rate; but, unlike postfundoplication gastric dysfunction, long-term outcomes appear to be better in patients who had an intentional vagotomy.

Our experience with gastric resection as a potential intervention for postfundoplication gastric dysfunction supports the concept that the initial approach for this disorder should be conservative. Interestingly, only about 1% of all gastroparesis patients develop symptoms after an antireflux procedure [10]. With this in mind, most patients with gastroparesis are treated by a gastroenterologist rather than a surgeon. Medical management of gastroparesis after fundoplication should include dietary changes, tricyclic antidepressants, and promotility agents including metoclopramide, domperidone, tegaserod, and erythromycin [10]. The decision for operative intervention should involve a multidisciplinary approach, including a gastroenterologist, psychologist, surgeon, dietitian, and pain specialist. Many operative options for gastroparesis have been explored and include gastrostomy, jejunostomy, gastric stimulation and pacing, pyloroplasty, and gastrectomy [24]. Near-total or completion gastrectomy appears to be the most viable option for patients with intractable symptoms and/or nutritional compromise who fail medical therapy. Pyloroplasty may be tried initially, but most patients with postgastrectomy gastroparesis have dysmotility of the entire stomach and not just the antropyloric “pump” [13, 14]. Pyloroplasty or simple gastrojejunostomy in these patients is unsuccessful. Although we suggest gastrectomy as the best option, our results are disappointing, with three of nine patients requiring supplemental nutrition. We stress, however, that these patients were a select group. Also, these poor outcomes after gastric resection for postfundoplication gastric dysfunction can be attributed to our incomplete understanding of gastroparesis and possibly the effect of vagal denervation of the small intestine in this population of patients. Their symptomatology and the pathogenesis of this disorder are likely multifactorial, with confounders of narcotic addiction, mental illness, preexisting dysmotility syndrome, and multiple previous operations.

Our retrospective design of this study has several limitations. First, the study involves patients referred to our tertiary medical center who had refractory symptoms and severe nutritional compromise due to their gastric dysfunction. Moreover, this study did not compare treatment outcomes of gastric resection with other options, such as pyloroplasty or, more appropriately, Roux-en-Y gastric

bypass. Several groups have combined pyloroplasty with fundoplication in patients with preoperative gastroparesis with comparable outcomes to patients with normal gastroesophageal reflux disease symptoms [25, 26]. Although no patients underwent combined pyloroplasty and fundoplication, one patient in this series had been treated previously with pyloroplasty, resulting in no alleviation of symptoms.

## Conclusions

Refractory postfundoplication gastric dysfunction is a rare disorder that is difficult to manage. Gastric resection did not relieve symptoms in most of the patients, and three of nine patients still require supplemental enteral nutrition. Based on the results of this study and the heterogeneity of this group of patients, each patient should be managed by a multidisciplinary team, exhausting all nonsurgical options prior to any operative intervention.

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