

# Gastrectomy as a Remedial Operation for Failed Fundoplication

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Published online: 18 January 2007  
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**Abstract** The decision for, and choice of, a remedial antireflux procedure after a failed fundoplication is a challenging clinical problem. Success depends upon many factors including the primary symptom responsible for failure, the severity of underlying anatomic and physiologic defects, and the number and type of previous remedial attempts. Satisfactory outcomes after reoperative fundoplication have been reported to be as low as 50%. Consequently, the ideal treatment option is not clear. The purpose of this study was to evaluate the outcome of gastrectomy as a remedial antireflux procedure for patients with a failed fundoplication. The study population consisted of 37 patients who underwent either gastrectomy ( $n=12$ ) with Roux-en-Y reconstruction or refundoplication ( $n=25$ ) between 1997–2005. Average age, M/F ratio, and preoperative BMI were not significantly different between the two groups. Outcome measures included perioperative morbidity, relief of primary and secondary symptoms, and the patients' overall assessment of outcome. Mean follow up was 3.5 and 3.3 years in the gastrectomy and refundoplication groups, respectively ( $p=0.43$ ). Gastrectomy patients had a higher prevalence of endoscopic complications of GERD (58% vs 4%,  $p=0.006$ ) and of multiple prior fundoplications than those having refundoplication (75% vs 24%,  $p=0.004$ ). Mean symptom severity scores were improved significantly by both gastrectomy and refundoplication, but were not significantly different from each other. Complete relief of the primary symptom was significantly greater after gastrectomy (89% vs 50%,  $p=0.044$ ). Overall patient satisfaction was similar in both groups ( $p=0.22$ ). In-hospital morbidity was higher after gastrectomy than after refundoplication (67% vs 20%,  $p=0.007$ ) and new onset dumping developed in two gastrectomy patients. In select patients with severe gastroesophageal reflux disease (GERD) and multiple previous fundoplications, primary symptom resolution occurs significantly more often after gastrectomy than after repeat fundoplication. Gastrectomy, however, is associated with higher morbidity. Gastrectomy is an acceptable treatment option for recurrent symptoms particularly when another attempt at fundoplication is ill advised, such as in the setting of multiple prior fundoplications or failed Collis gastroplasty.

**Keywords** Gastrectomy · Fundoplication ·  
Gastroesophageal reflux disease

## Introduction

Laparoscopic Nissen fundoplication has become the most commonly performed surgical procedure for control of gastroesophageal reflux disease (GERD). Although long-term studies suggest an approximately 80–90% life-long symptom relief after a Nissen procedure, 10 to 20% of patients will develop recurrent symptoms and are referred for consideration of reoperative surgery.<sup>1–5</sup> Achievement of a successful outcome with remedial antireflux surgery is a challenge and depends upon many factors including the symptoms responsible for failure, the severity of underlying anatomic and physiologic defects, and the number and type of previous operative attempts. Experience has shown that

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Presented at the 47th Annual Meeting of the Society for Surgery of the Alimentary Tract, Los Angeles, California, May 20–24, 2006.

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failure after refundoplication is higher than after a first-time fundoplication. Further, the greater number of repairs a patient has undergone, the higher the incidence of a poor outcome, with resolution of symptoms occurring in as few as 50% of patients after multiple attempts.<sup>6–8</sup> With each reoperation at the gastroesophageal junction, the recreation of an anatomically functional barrier becomes more difficult and is sometimes impossible.

An alternative to refundoplication is resection of all or part of either the esophagus or stomach. The decision for resection is complex in the setting of failed antireflux surgery, and outcomes are not well documented. Although esophagectomy is an alternative, it is a major surgical undertaking associated with considerable morbidity and may involve extirpation of what often is an anatomically and functionally normal organ. This leaves gastrectomy as perhaps the most attractive resection option. The perioperative risks, symptomatic outcome, side effects, and patient satisfaction after gastrectomy as a remedial antireflux procedure are poorly understood and form the basis for this study.

## Methods

### Study Population

Approval from our institutional review board was obtained before the start of this study. Thirty-seven patients with failed fundoplication who underwent remedial antireflux surgery by a single surgeon (TJW) during the years 1997 to 2005 were retrospectively evaluated. Twenty-five patients underwent refundoplication and 12 patients underwent gastrectomy with Roux-en-Y reconstruction as a remedial procedure. Patients who underwent esophagectomy for failed fundoplication were not included in this study.

Preoperative symptoms and evaluation, past surgical history, and perioperative data for both groups of patients were collected through retrospective review of both inpatient and outpatient charts. Routine preoperative evaluation included flexible upper endoscopy, barium upper gastrointestinal radiography, and stationary esophageal manometry. Ambulatory esophageal pH monitoring and gastric emptying scintigraphy were used selectively, depending upon clinical need.

### Outcome Assessment

Patients were contacted after remedial surgery via telephone and interviewed regarding current symptoms and change in symptom frequency. Both typical (heartburn, regurgitation, dysphagia) and atypical (odynophagia, chest pain, epigastric pain, cough, choking, nausea, vomiting) symptoms

were queried. The primary symptom was considered the presenting symptom documented preoperatively as most bothersome to the patient. Additional symptoms were considered secondary. Both pre- and postoperative symptoms were assigned a standardized symptom severity score (Table 1). Patients were also asked to give an overall subjective assessment of their outcome. Specifically, they were asked whether they considered themselves improved, cured or worsened, whether they were satisfied with the result of their surgery, and whether they would undergo the same remedial operation again if given the choice.

Mean follow up after surgery was 3.3 and 3.5 years in the refundoplication and gastrectomy groups, respectively ( $p=0.43$ ). Follow-up was obtained in 88% (22/25) of patients who underwent refundoplication and 83% (10/12) of patients who had a gastrectomy. Outcome measures included perioperative morbidity, relief of primary and secondary symptoms, and the patients' overall assessment of outcomes.

### Statistics

The Student *t* test was used to compare continuous data between individual groups. Chi-square or Fischer exact test was used to compare proportions between individual groups. The Wilcoxon or Mann–Whitney *U* test was used for paired and unpaired, independent, nonparametric data. A *p* value of less than 0.05 defined statistical significance.

## Results

### Clinical Features

Demographic data for the refundoplication and gastrectomy patients are shown in Table 2. There was no significant difference in age or gender between the groups. Mean preoperative body mass index (BMI) was also similar, as was the prevalence of typical and atypical symptoms. Weight loss was observed in both groups after remedial surgery, with refundoplication patients losing significantly less weight than those in the gastrectomy group ( $p=0.004$ ). Mean postoperative BMIs, however, remained within

**Table 1** Symptom Severity Score

Score	Symptom severity
4	Symptom occurs daily.
3	Symptom occurs less than once per day.
2	Symptom occurs less than once per week.
1	Symptom occurs less than once per month.
0	Asymptomatic

**Table 2** Demographic Data

	Refundoplication (n=25)	Gastrectomy (n=12)	p value
Mean age	50±10	51±9.9	0.83
M/F	7:18	2:10	0.25
Preoperative BMI	28.9±5.3 (range 19.3–41.2)	29.6±6.7 (range 17.6–40.4)	0.83
Postoperative BMI	26.8±4.6 (range 20.4–41.1)	21.6±4.1 (range 16.3–29.3)	0.004*
Primary symptom:			0.104
Typical	68% (n=17)	91.7% (n=11)	
Atypical	32% (n=8)	8.3% (n=1)	
Endoscopic disease:	4.0% (1/25)	58.3% (7/12)	0.006*
Esophagitis	1	7	
Barrett’s	0	1	
Stricture	0	1	

\*p<0.05 considered statistically significant

normal range. More than half (58%) of patients undergoing gastrectomy had endoscopic evidence of esophagitis, stricture or Barrett’s esophagus (BE) representing more complicated GERD than those in the refundoplication group (p=0.006). All patients undergoing gastrectomy had adequate preoperative esophageal body function established by video esophagography or stationary esophageal manometry. No patient who underwent refundoplication had evidence of severe gastroparesis, as determined by either gastric emptying scintigraphy or upper endoscopy.

Table 3 shows the number and type of prior antireflux procedures in each treatment group. Patients undergoing gastrectomy had a significantly higher incidence of more than one prior antireflux procedure (75%) compared to patients who underwent refundoplication (24%; p=0.004). Of the patients undergoing refundoplication, 19 (76%) had one previous fundoplication and six (24%) had two. No patients in this group had more than two prior procedures.

**Table 3** Number and Type of Previous Antireflux Operations

	Number of Previous Funduplications	Refundoplication (n=25)		Gastrectomy (n=12)	
		Number of Patients	Surgery Type	Number of Patients	Surgery Type
	One	19	14 LAP 5 TA	3	1 LAP 1 TA/COLLIS 1 TT/COLLIS
	Two	6	2 TA: TA 2 LAP: TA 2 LAP: LAP	7	1 TA: TA 1 TA: TT 2 TA: TA/COLLIS 2 LAP: TA 1 LAP: LAP
	Three	0		1	1 Angelchik: TA: TA
	Four	0		1	1 LAP: LAP: LAP: Attempted Redo TA

TA=Open transabdominal fundoplication, TT=Transthoracic fundoplication, LAP=Laparoscopic fundoplication

Of patients undergoing gastrectomy, three (25%) had one prior fundoplication, seven (58.3%) had two, one (8.3%) patient had three and one (8.3%) patient had four. In the three patients with only one prior fundoplication, gastrectomy was chosen because of prior Collis gastroplasty (n=2) or because of concomitant severe gastroparesis (n=1).

**Remedial Operations and Mechanisms of Failure**

Remedial surgery in the refundoplication group consisted of 20 left transthoracic and five open transabdominal funduplications. One patient who had a transabdominal fundoplication underwent a concomitant distal esophageal myotomy. Remedial surgery in the gastrectomy group consisted of six near-total, four proximal, and two total gastrectomies, all with Roux-en-Y reconstruction. The proximal extent of gastrectomy was determined by intraoperative assessment of the suitability of the proximal stomach for reconstruction, with the intent of leaving a minimal proximal gastric remnant. Near-total gastrectomy was defined by resection of at least 85–90% of the distal stomach, whereas with proximal gastrectomy a distal gastric remnant was preserved. The Roux limb was typically 45 to 60 cm in length.

Intraoperative assessment of the mechanism of failure of the prior fundoplication was carried out in all patients. Recurrent hiatal hernia was identified in 91% (21/23) of the refundoplication group. Of these patients, eight had an associated slipped fundoplication and one had a complete disruption. Of the two refundoplication patients without hiatal hernia, one was thought to have an intact but loose fundoplication and one was found to have a slipped fundoplication. Recurrent hiatal hernia was also present in the majority (66.6%, 8/12) of those undergoing gastrectomy. Of these patients, two also had a slipped fundoplication, two had previous Collis gastroplasty and one had complete disruption of the fundoplication. Of the remaining

gastrectomy patients without hiatal hernia, one patient was found to have a tight fundoplication secondary to mesh placed at the hiatus, two patients had an intact fundoplication but an improperly tailored Collis gastroplasty, and one patient had an intact fundoplication with previous gastrojejunostomy and severe gastroparesis.

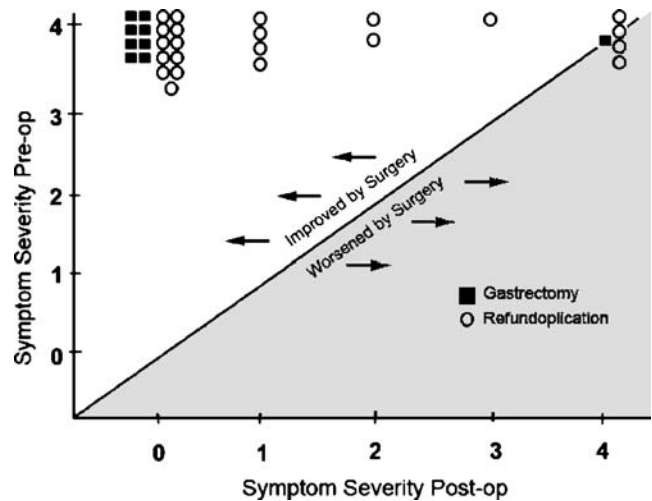
### Outcomes

Complications occurred in 20% (5/25) of patients after refundoplication and 67% (8/12) of patients after gastrectomy ( $p=0.007$ ). The number and nature of complications in each group are shown in Table 4. One patient died after gastrectomy secondary to ARDS and sepsis. Median hospital stay was shorter for patients undergoing refundoplication (6 days, range 3–12) compared to those undergoing gastrectomy (10 days, range 6–38;  $p<0.001$ ).

Complete relief of the primary symptom was significantly less likely after refundoplication (50%) than after gastrectomy (89%;  $p=0.044$ , Fig. 1). Before refundoplication, primary symptoms included heartburn ( $n=10$ ), dysphagia ( $n=4$ ), regurgitation ( $n=3$ ), epigastric pain ( $n=4$ ), chest pain ( $n=1$ ), choking ( $n=2$ ) and vomiting ( $n=1$ ). Before remedial gastrectomy, primary symptoms included heartburn ( $n=7$ ), dysphagia ( $n=2$ ), regurgitation ( $n=2$ ), and chest pain ( $n=1$ ).

When defined as complete relief of the primary symptom and no further surgery required, success was achieved in 47.8% of refundoplication patients and in 89% of gastrectomy patients ( $p=0.035$ ). Four of the patients in the refundoplication group failed remedial surgery. Of these, three went on to have a gastrectomy and one underwent a third fundoplication. The reason for failure in two of the patients who went on to gastrectomy was symptomatic recurrent hiatal hernia. The remaining two failures underwent remedial surgery for unknown reasons. No patient who failed fundoplication, however, had preexisting esophageal body dysfunction or gastroparesis.

Figure 2 shows the mean change in symptom severity scores before and after refundoplication or gastrectomy.



**Figure 1** Relief of primary symptom after refundoplication ( $n=22$ ) versus gastrectomy ( $n=9$ ) in patients with previous failed fundoplication. Complete primary symptom resolution, as defined by a postoperative symptom severity score of zero, was seen in 50% of patients following refundoplication and 89% of patients following gastrectomy ( $p=0.004$ ). All data points above or below the centerline indicate improvement or worsening of symptom severity, respectively. Data points on the centerline indicate no change in symptom severity.

Marked improvements in mean symptom scores were seen for all symptoms in both groups. Further, mean pre- and postoperative symptom scores were not significantly different between groups. Postoperative dumping syndrome was reported by two of the gastrectomy patients.

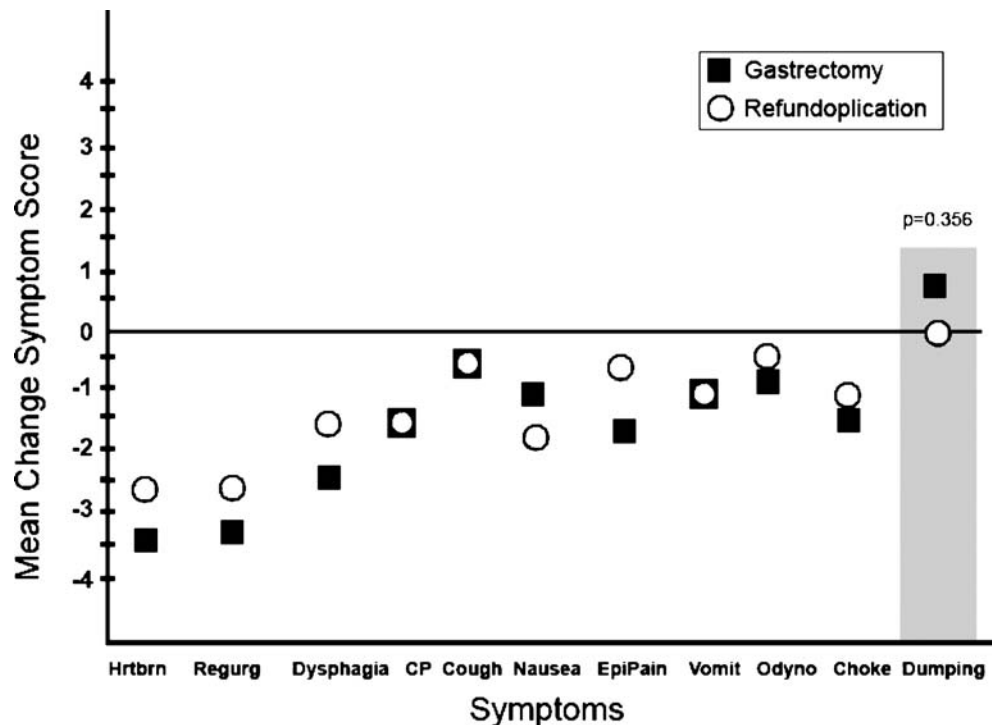
Eighty-two percent of patients after refundoplication and 85% of patients after gastrectomy considered themselves improved or cured ( $p=0.351$ ). Eighty-three percent of patients after refundoplication and 67% of patients after gastrectomy were satisfied with their outcome ( $p=0.220$ ). When asked whether they would undergo the same reoperative procedure again if given the choice, 83% of patients after refundoplication and 34% of patients after gastrectomy would do so ( $p=0.011$ ). In the refundoplication group, the reasons cited for not choosing to undergo the same remedial surgery again were postoperative pain ( $n=1$ ) and persistent symptoms ( $n=2$ ). In the gastrectomy group,

**Table 4** Perioperative Complications

	Refundoplication (5/25) 20%*	Gastrectomy (8/12) 67%*	
Wound infection	1	Wound infection	4
Pulmonary:	2	Pulmonary:	3
Intraop pneumothoraxrequiring chest tube	2	Pneumonia	2
Phlebitis	2	Respiratory failure	1
Bacteremia	1	Anastomotic leak	2
Urinary tract infection	1	Hepatic abscess	1
		Pancreatitis (Violation of pancreatic head intraop, drain left)	1
		Evisceration	1
		Death	1

\* $p=0.007$

**Figure 2** Mean change in symptom severity scores before and after refundoplication or gastrectomy. Marked improvement in mean symptom scores was seen for all symptoms in both groups. New onset dumping syndrome was seen in the gastrectomy group ( $p=0.356$ ).



the reasons cited were prolonged postoperative course ( $n=4$ ) and the development of dumping syndrome ( $n=2$ ).

## Discussion

Patients referred with a failed fundoplication present a surgical challenge. Our data demonstrate that in select patients with severe GERD and failed fundoplication, primary symptom resolution occurs significantly more often after gastrectomy than after repeat fundoplication. These results occurred despite the fact that patients undergoing gastrectomy had a higher prevalence of complications of GERD including persistent esophagitis, stricture, and BE than those undergoing refundoplication. In addition, patients undergoing gastrectomy had a higher prevalence of multiple prior fundoplications, making refundoplication a poor option owing to the severity of the anatomical and functional derangements involving the gastroesophageal junction or stomach.

When comparing pre- and postoperative symptoms, mean severity scores were markedly improved by both refundoplication and gastrectomy. Not only was the magnitude of improvement similar between the two groups, but the severity of postoperative symptoms was also similar. On the other hand, complete resolution of the primary symptom was significantly more likely after gastrectomy (89%) than after refundoplication (50%). Further, four of the refundoplication patients went on to undergo another remedial procedure. If these patients are

considered surgical failures, the outcome difference is further enhanced between the patients undergoing gastrectomy and those undergoing refundoplication. There was a cost to the choice of gastrectomy, however, reflected in a higher perioperative morbidity and new onset of dumping, which developed in two patients. Based on these findings, we conclude that in select patients with severe GERD having undergone multiple previous fundoplications, gastrectomy is an acceptable treatment option for recurrent symptoms. This conclusion is particularly true when another attempt at fundoplication is ill-advised, such as in the setting of two or more prior fundoplications, failed Collis gastroplasty, or severe gastroparesis. We would not consider gastrectomy after a first-time failed fundoplication, unless anatomic or physiologic circumstances, such as described above, prohibited refundoplication.

The decision to attempt a repeat fundoplication can be difficult. Many factors must be considered, including the nature and severity of ongoing symptoms, the anatomic or physiologic parameters contributing to failure, the type of prior antireflux procedures performed, the patient's underlying comorbidities and body habitus, and the success of nonsurgical therapies in controlling symptoms. Refundoplication in the setting of a failed Collis gastroplasty, for instance, may not be technically feasible. Similarly, refundoplication in the setting of severe gastroparesis would be expected to lead to a poor functional outcome and should be avoided. In addition, reoperation in patients who have had two or more prior fundoplications has been associated with poor outcomes.

Whereas some authors have reported acceptable outcomes after first time refundoplication<sup>7–11</sup> reports after two or more refundoplications have been less than desirable. In reviewing the experience from 1973 to 1989 of 413 patients who underwent fundoplication for GERD, Skinner et al. found that 28% required reoperation. Although a good clinical outcome was seen in a majority of first-time refundoplications, success fell to 66% after a third repair and to less than 50% after a fourth-time repair.<sup>6</sup> In a more recent prospective evaluation of 1892 patients who underwent fundoplication between 1991 and 2004, Smith et al. found an initial revision rate of 2.8%. In a subset of 22 of these patients who required more than one refundoplication, the rate of revision was found to be more than twice this initial rate.<sup>8</sup> Thus, the success of fundoplication appears to decrease with each additional reoperation.

When patients referred for remedial surgery are considered poor candidates for refundoplication, the decision commonly becomes whether to perform an esophagectomy or gastrectomy for persistent severe symptoms. Although we have performed esophagectomy for failed fundoplication, the number of patients who underwent this procedure is small, and we chose not to include them in this analysis. Outcomes after esophagectomy for benign disease, however, have been extensively reported in the literature.<sup>12–15</sup> The morbidity of esophageal replacement can be considerable. In patients with failed fundoplication, the esophagus may be normal both anatomically and physiologically, which argues for its preservation. An esophagectomy, by definition, positions a replacement organ in the thorax predisposing the patient to regurgitation. In addition, esophagectomy in the reoperative setting may require more than one incision, such as a thoracotomy or cervicotomy in addition to a laparotomy. In our opinion, patients with normal esophageal motility, as assessed by video esophagography or stationary esophageal manometry, would better be served by gastrectomy rather than esophagectomy when foregut replacement is contemplated.

Compared to esophagectomy, gastric resection is associated with a number of potential benefits. The native esophagus is left intact, which allows propagation of a food bolus distally and acts as a barrier against the reflux of gastric or intestinal contents into the pharynx or airway. In addition, gastric resection typically can be completed through a laparotomy incision alone. End-stage reflux disease is frequently associated with gastric stasis or delayed gastric emptying, which is addressed via a gastric resection. Finally, in the setting of significant obesity, weight loss from gastric diversion can be a significant associated medical benefit. The use of partial gastrectomy or antrectomy with Roux-en-Y reconstruction as a treatment for patients with severe esophagitis and stricture

formation has been described. Salo et al. reported the outcome of partial gastrectomy as a remedial treatment for six patients with persistent esophagitis after fundoplication and found complete endoscopic resolution in 83%.<sup>16</sup> A subsequent study by this same group reevaluated these patients along with two additional patients after a follow-up of 4 years and found all patients to be asymptomatic with complete endoscopic resolution of esophagitis. In addition, postoperative ambulatory esophageal pH monitoring normalized.<sup>17</sup>

Csendes et al. reported on vagotomy and antrectomy with long-limb Roux-en-Y gastrojejunostomy as the preferred treatment option for patients with long-segment BE.<sup>18,19</sup> This choice of operation was based on the observations that fundoplication in the setting of BE is associated with a relatively high long-term failure rate, and that a small proportion of patients with BE develop dysplasia or carcinoma in follow-up. As duodenogastric reflux is common in patients with BE, and as components of the duodenal refluxate are thought to be carcinogenic or injurious to the esophageal mucosa, antrectomy with Roux-en-Y diversion theoretically diverts the damaging components of the gastric refluxate from the esophageal mucosa. Because of the added complexity and potential morbidity of such a reconstruction compared to fundoplication, especially when the latter can be performed via a laparoscopic approach, the operation as proposed by Csendes has not gained wide acceptance in the US and Europe.

An issue of controversy is whether the distal gastric remnant need be removed after proximal gastrectomy. Whereas such a resection is typically not performed in the setting of Roux-en-Y gastric bypass (RYGBP) for obesity, resection does appear to reduce or eliminate the potential risks of hemorrhage from the blind gastric pouch, the occurrence of gastrogastic fistula, the development of marginal ulceration due to a retained antrum effect, bacterial overgrowth in the excluded pouch, or development of a subsequent carcinoma, which is not amenable to surveillance.<sup>20</sup> RYGBP with distal gastric resection clearly is more time-consuming and requires more extensive dissection than RYGBP without distal resection. Whether the benefits of distal gastric resection outweigh the disadvantages merits further study and follow-up.

## Conclusion

Based on our findings, we conclude that in select patients with severe GERD and multiple previous fundoplications, primary symptom resolution occurs significantly more often after gastrectomy than after repeat fundoplication. Gastrectomy, however, is associated with higher morbidity. Gastrectomy is an acceptable treatment option for recurrent symptoms

particularly when another attempt at fundoplication is ill-advised, such as in the setting of multiple prior fundoplications, failed Collis gastroplasty, or severe gastroparesis. The indications for gastrectomy with Roux-en-Y reconstruction in the reoperative setting, the pros and cons relative to esophagectomy, whether to resect the distal gastric remnant, and the situations where a repeat attempt at fundoplication should be abandoned require further elucidation.

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