

Dysphagia After Laparoscopic Antireflux Surgery

The Impact of Operative Technique

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Background

Concerns about laparoscopic antireflux surgery include the frequent appearance of troublesome postoperative dysphagia. This study reviews the frequency of early (less than 6 weeks) and persistent (greater than 6 weeks) solid food dysphagia in patients undergoing Toupet, Rosetti-Nissen, or Nissen funduplications.

Methods

One hundred eighty-four consecutive patients with normal esophageal peristalsis undergoing laparoscopic antireflux surgery were prospectively studied. Before operation, all patients had endoscopy, 24-hour pH study, and an esophageal motility study. The choice of operation was dependent on anatomy and surgeon preference. Before discharge, all patients were given instructions on a soft diet. Postoperative symptoms were scored by the patients as absent, mild, moderate, or severe 4 weeks and 12 weeks after operation. The option of esophageal dilatation was offered to patients with moderate to severe persistent solid food dysphagia.

Results

New onset moderate to severe dysphagia to solid foods was present in 30 (54%), 8 (17%), and 13 (16%) patients undergoing Rosetti-Nissen, Nissen, and Toupet funduplications, respectively, in the first month after operation ($p < 0.001$). Moderate to severe dysphagia persisted at 3 months in six (11%), one (2%), and two (2%) patients undergoing laparoscopic Rosetti-Hell, Nissen, and Toupet funduplications, respectively ($p < 0.05$). Esophageal dilatation was performed in five (4%), zero, and one (1%) patients undergoing laparoscopic Rosetti-Nissen, Nissen, and Toupet funduplications, respectively ($p < 0.05$). There was no additional morbidity related to division of short gastric vessels in patients undergoing Nissen fundoplication.

Conclusions

Laparoscopic Rosetti-Nissen fundoplication is associated with a higher rate of early and persistent postoperative dysphagia than either laparoscopic Nissen fundoplication or Toupet fundoplication. Consideration of complete fundus mobilization should be a part of all laparoscopic antireflux procedures.

Laparoscopic Nissen fundoplication, first reported in 1991, has seen a tremendous growth in popularity in the last 4 years.¹⁻⁸ Similar postoperative side effects are seen with both laparoscopic and open Nissen fundoplication.⁹⁻¹² Comparing these recent reports with earlier reports of open Nissen fundoplication, it appears that troublesome, persistent solid food dysphagia is more frequent after laparoscopic Nissen fundoplication (range, 4-24%), than after open "floppy" Nissen fundoplication (< 3%).^{11,13,14} Moreover, it also appears that dysphagia is more common after laparoscopic Rosetti-Nissen fundoplication than after laparoscopic Nissen fundoplication, with greater curvature mobilization.^{5,6,8} Many surgeons have adopted the subtotal, Toupet fundoplication, as a means to reduce the frequency of dysphagia and bloating seen with laparoscopic Rosetti-Nissen fundoplication.³ Because appearances may be deceiving, we were hesitant to draw conclusions about optimal surgical technique by comparing reported results by different surgeons with different outcome definitions.

In this study, we prospectively compared the incidence of postoperative solid food dysphagia during a period of time when we were performing three laparoscopic operations for gastroesophageal reflux disease. The choice of operation was based on the anatomy of the gastroesophageal junction, rather than esophageal motility study or preoperative reflux symptoms.

PATIENTS AND METHODS

Patient Population and Indications

One hundred eighty-four patients underwent surgery for medically refractory gastroesophageal reflux disease between October 28, 1991, and November 25, 1993. Eighty three patients underwent Toupet fundoplication, 46 patients underwent Nissen fundoplication, and 55 patients underwent Rosetti-Nissen fundoplication. All demographic data, symptom scores, intraoperative and postoperative data were attained prospectively and entered into a database. Patient demography is shown in Table 1.

Clinical Evaluation and Choice of Operation

Before surgery, each patient underwent history and physical examination, and responded to a symptom questionnaire specific for typical and atypical gastro-

Table 1. CHARACTERISTICS OF PATIENTS UNDERGOING LAPAROSCOPIC ANTIREFLUX SURGERY: OCTOBER 28, 1991-NOVEMBER 25, 1993

| | Toupet | Rosetti-Nissen | Nissen |
|--|------------|----------------|------------|
| Mean age (yr) | 43 | 49 | 48 |
| Sex | 47 M, 36 F | 30 M, 25 F | 26 M, 20 F |
| Procedure performed 10/28/91-7/1/92 | 14 | 14 | — |
| Procedure performed 7/2/92-11/25/93 | 69 | 41 | 46 |
| Total | 83 | 55 | 46 |

— = Nissen fundoplication with greater curvature mobilization was not performed during the first 8 months.

esophageal reflux disease symptoms. An esophageal motility study, 24-hour ambulatory esophageal pH monitoring, esophagogastroduodenoscopy and barium swallow also were performed on all patients. Patients with extremely poor esophageal motility (esophageal body contraction amplitude < 30 mmHg) were excluded from operation during this study period.

From October 28, 1991, to July 1, 1992, all Nissen fundoplications were performed with the Rosetti-Hell modification, as part of a multicenter trial of laparoscopic antireflux surgery.³ In this trial, patients with a hiatal hernia underwent Rosetti-Nissen fundoplication and those without a hiatal hernia underwent Toupet fundoplication. All operations were performed by the two surgeons (JH, LS) working as a team.

At the completion of the trial, the same criteria generally were used; however, the decision to divide short gastric vessels was based on the mobility of the gastric fundus. If the anterior wall of the gastric fundus was sufficiently redundant to reach the right side of the esophagus and remain there without traction, the short gastric vessels were not divided, and a Rosetti-Nissen fundoplication was sutured after passage of a large Maloney dilator (see following section). If, on release of traction, the fundus slipped back behind the esophagus, a standard Nissen fundoplication with short gastric division and complete fundus mobilization was performed.

OPERATIVE TECHNIQUE

Toupet Fundoplication

Toupet fundoplication was popularized by Boutelier and Jansson.¹⁵ When performed laparoscopically, a five-port technique was used (Fig. 1). The left lobe of the liver was elevated with an expandable retractor. The left triangular

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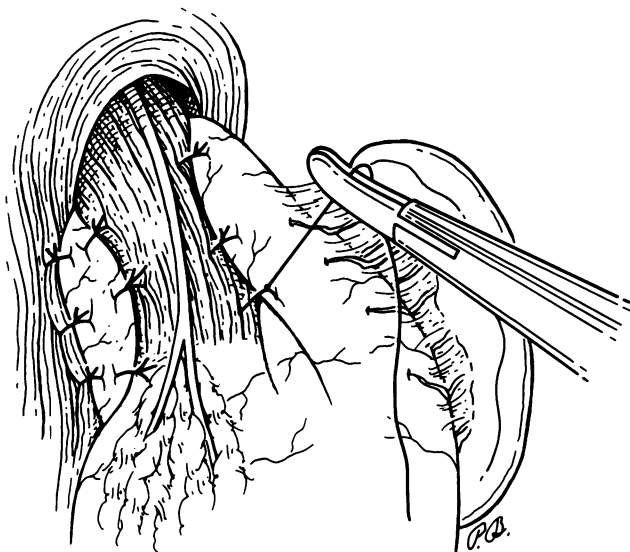


Figure 1. Toupet fundoplication. Trocar position.

ligament of the liver was not divided. The phrenoesophageal ligament was divided with electrosurgery, and the left and right diaphragmatic crura were cleaned of fat and connective tissue. The posterior esophagus was dissected under direct vision with blunt nosed graspers and a 30° or 45° angled telescope, leaving the vagus nerve away from the esophagus. A vessel loop or Penrose drain was passed around the esophagus and subsequently used to retract the esophagus inferiorly. A generous posterior window was created behind the esophagus. The stomach and diaphragm were separated from the angle of His to the superior pole of the spleen. The gastrosplenic omentum and short gastric vessels were left undisturbed. A grasper was passed right to left behind the well mobilized esophagus and a portion of the anterior wall of the gastric fundus was pulled behind the esophagus. With the first assistant holding the fundus tight to the esophagus and pulling anteriorly to the left, the surgeon anchored the fundus to the left crus of the diaphragm with two interrupted silk sutures, and to the right crus of the diaphragm with three interrupted sutures. All knots were tied intracorporeally. A Maloney dilator, 54- to 60-French, was inserted, and the fundus was anchored to the anterior wall of the esophagus, on either side of the anterior vagus nerve, with three interrupted sutures of 2-0 silk or, more recently, with 2-0 braided nylon. The two superior-most fundoplication sutures on either side of the esophagus included the crura of the diaphragm. The fundoplication extended 180° to 300° around the esophagus (Fig. 1).

Rosetti-Nissen Fundoplication

Laparoscopic Rosetti-Nissen fundoplication has been well described elsewhere.¹⁶ The mobilization of esopha-

gus and gastric fundus was identical to that performed for Toupet fundoplication. After dissection, the diaphragmatic crura were closed posteriorly with two or more interrupted 0-silk or braided nylon sutures. The mobilized fundus of the stomach was brought behind the esophagus, and a three-stitch, 2-cm Nissen fundoplication was created over a 56- to 60-French dilator. Generally, 2-0 sutures were used for fundoplication. Each suture included a full thickness "bite" of the stomach wall and a partial thickness "bite" of the esophageal wall. The superior most suture often included a "bite" of the anterior crural arch (Fig. 2).

Laparoscopic Nissen Fundoplication

This technique was identical to the two described previously, except that the short gastric vessels and posterior attachments of the fundus were taken down over a distance of approximately 10 cm from the angle of His. The short gastric vessels were divided between clips starting inferiorly and working cephalad. In addition to mobilizing the fundus from the tip of the spleen, several posterior vessels between the tail of the pancreas or diaphragm and the cardia of the stomach were divided to allow complete visualization of the left crus of the diaphragm through the lesser sac. Again, a trial fundoplication was performed, and if a generous portion of fundus remained to the right of the esophagus without traction, greater curvature mobilization was considered complete. A 2-cm fundoplication was performed with three interrupted sutures over a 56- to 60-French dilator and then fixed to the undersurface of the diaphragm (Fig. 3).

POSTOPERATIVE CARE

Nasogastric tubes initially were placed on suction overnight, but were not used routinely after the first 20

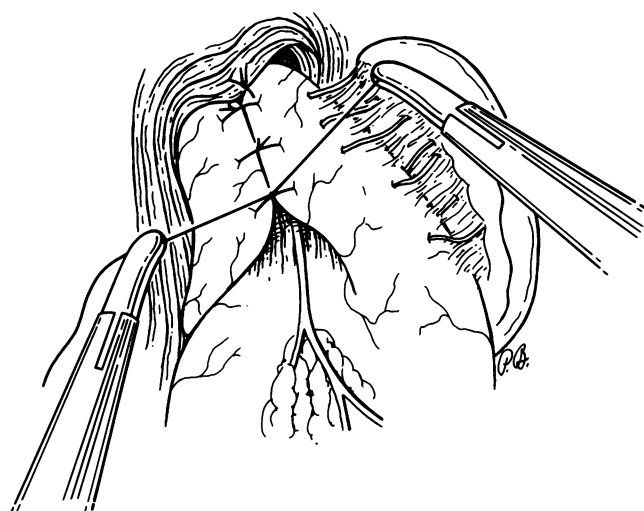


Figure 2. Rosetti-Nissen fundoplication.

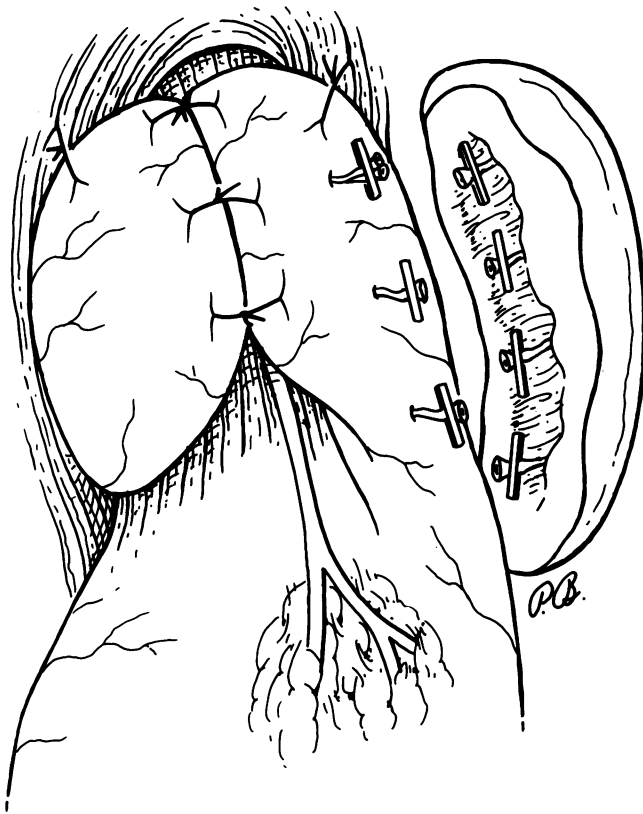


Figure 3. "Floppy" Nissen fundoplication.

procedures. On the day after surgery, patients were started first on clear liquids and later that day, a soft diet was instituted. The patients were given detailed counseling on avoiding meats, breads, and raw vegetables for 3 weeks after operation. Discharge generally occurred on the second postoperative day. The initial follow-up visit occurred 4 weeks after operation, and a second visit occurred 2 months later. Patients with postoperative difficulties were seen more frequently. At each clinic visit, all patients completed the same questionnaire that was used preoperatively, grading symptoms on a scale from 0 to 3 (0 = absent, 1 = mild, 2 = moderate, 3 = severe). Those patients who reported severe dysphagia at the first postoperative visit or moderate to severe dysphagia at the second follow-up visit were offered endoscopy and esophageal dilatation.

STATISTICAL METHODS

The development of early postoperative dysphagia was compared between operative groups using chi-square analysis. The frequency of persistent dysphagia and need for esophageal dilatation were compared using Fisher's exact test.

RESULTS

New-onset solid food dysphagia was seen in 30 patients (54%) undergoing Rosetti-Nissen fundoplication, 13 patients (16%) undergoing Toupet fundoplication, and 8 patients (16%) undergoing Nissen fundoplication in the first month after surgery ($p < 0.001$ Rosetti-Nissen vs. Toupet or Nissen; Table 2). Three months postoperatively, dysphagia had resolved in all but six patients (11%) after Rosetti-Nissen fundoplication, two patients (2%) after Toupet fundoplication, and one patient (2%) after Nissen fundoplication ($p < 0.05$, Toupet vs. Rosetti-Nissen). Esophageal dilatation was performed in five patients (9%) after Rosetti-Nissen, one patient (2%) after Toupet fundoplication, and was not required in any patient after Nissen fundoplication ($p < 0.05$, Rosetti-Nissen vs. Toupet or Nissen). In all cases, dysphagia improved after a single dilatation. No return of reflux symptoms was noted in any patients dilated. Repeat dilatations were not performed, yet residual dysphagia to meats and bread are present in four patients (80% of those dilated) after Rosetti-Nissen fundoplication. Remedial operation for refractory dysphagia was offered, but it was declined by all four patients.

The development of postoperative dysphagia was distributed evenly across the time period of this study, and not heavily weighted toward early cases or toward the surgeon performing the operation. Toupet and "floppy" Nissen fundoplication took 30 to 45 more minutes to perform than Rosetti-Nissen because of the additional suturing (Toupet) and greater curvature mobilization (Nissen).

Neither transfusion nor splenectomy was necessary in any patient in this series, and blood loss was not appreciably greater after greater curvature mobilization. Most intraoperative bleeding resulted from retractor related liver laceration or inadequate coagulation of vessels around the gastroesophageal junction. There were two esophageal perforations—one from a nasogastric tube and one from a Maloney dilator. Gastric perforations re-

Table 2. MODERATE TO SEVERE DYSPHAGIA TO SOLID FOODS

| | Toupet | Rosetti-Nissen | Nissen |
|---------------------|----------|----------------|---------|
| n | 83 | 55 | 46 |
| Early (<6 wks) | 13 (16%) | 30 (54%)* | 8 (17%) |
| Persistent (>6 wks) | 2 (2%) | 6 (11%)† | 1 (2%) |
| Patients dilated | 1 (1%) | 5 (9%)‡ | 0 |

* $p < 0.001$, chi square; Rosetti-Nissen vs. Toupet or Nissen.

† $p < 0.05$, Fisher's exact test: Rosetti-Nissen vs. Toupet.

‡ $p < 0.05$, Fisher's exact test: Rosetti Nissen vs. Toupet or Nissen.

sulted from overvigorous retraction in three cases. All perforations were recognized and repaired intraoperatively without subsequent complication. Gastric distention occurred in two patients within 8 hours of surgery and was relieved with overnight nasogastric decompression. There was no operative mortality in this series.

DISCUSSION

Laparoscopic antireflux surgery is rapidly replacing the traditional operations for treatment of medically refractory gastroesophageal reflux disease. For these procedures to capture the hearts and the minds of gastroenterologists, troublesome side effects must be minimized and long-term function must be proven. Although it is premature to draw conclusions about the long-term function of these repairs, side effects can be assessed, and subsequently minimized, by prospective comparison of several operative techniques performed by a single surgeon or a small group of surgeons working together. This study makes such a comparison.

In a recent series of 127 patients undergoing *open* Rosetti-Nissen fundoplication persistent dysphagia was present in 42%.¹² In this study, a long (3–5 cm) fundoplication was created over a small (32 French) dilator. In two reports of laparoscopic Rosetti-Nissen fundoplication, persistent (> 3 months) moderate to severe dysphagia was reported in 24% and 20% of all patients.^{5,6} In a recent report of laparoscopic “floppy” Nissen fundoplication, persistent moderate dysphagia was seen in 6% of patients.⁸ In several series of open Nissen fundoplication, persistent dysphagia was seen in less than 3% of patients.^{11,13,14,17} These last “best” results were attained by careful analysis of operative results and subsequent procedure modification to correct undesirable side effect profiles. In one landmark study of open fundoplication, the incidence of temporary and persistent dysphagia was decreased from 83% to 39%, and from 21% to 3%, respectively, by shortening the length of fundoplication, increasing dilator caliber, and mobilizing the greater curvature of the stomach. Because all three modifications occurred at once, it was difficult to isolate the individual contribution of greater curvature mobilization, yet complete sphincter relaxation was present more frequently after full fundus mobilization than without fundus mobilization.¹¹

After review of this literature, it was unclear whether all variables—the length of the fundoplication, the size of the dilator, and mobilization of the greater curvature—were equally important in preventing postoperative dysphagia. When we embarked on a program of laparoscopic antireflux surgery, we hypothesized that greater curvature mobilization was unimportant, that we could achieve a low rate of dysphagia by performing a

short (2 cm) Rosetti-Nissen fundoplication over a large (> 54 French) dilator. We were wrong. The important finding of this study is that the rate of moderate to severe temporary and persistent dysphagia seen after Toupet or “floppy” Nissen fundoplication is significantly less than that seen after a short Rosetti-Nissen fundoplication performed around a large dilator.

When the surgeon, size of dilator, length of fundoplication, outcome definition, and means of reporting are the same, the explanation for a greater frequency of solid food dysphagia after the Rosetti-Nissen fundoplication is reasonably clear. When the anterior wall of the stomach is used for fundoplication rather than the true fundus, only half of the tissue available for creating the nipple valve is used. The redundancy of tissue available in the posterior gastric wall is wasted, lessening the likelihood that a tension-free Nissen fundoplication will be created. Also, when the fundus remains tethered to the spleen, tension on the Rosetti-Nissen fundoplication results from elasticity in the stomach and gastrosplenic attachments. This tension will occasionally cause the fundoplication and distal esophagus to twist counterclockwise (as viewed from below) when surgical traction and the Maloney dilator are removed, resulting in a narrow “spiral” gastroesophageal valve (Fig. 4). This valve deformity may cause obstruction to bolus food passage, but because there is no stricture, it may be refractory to dilatation. Dilatation attempts merely to uncurl the spiral, which reforms on removal of the dilator. The manometric finding of incomplete lower esophageal sphincter relaxation was associated with this deformity in our series, recapitulating earlier findings.¹¹ The tension residing in the greater curvature also may help explain the greater failure rate of the Rosetti-Nissen fundoplication when prospectively compared with Toupet fundoplication.¹⁸ Another anatomic trap of the Rosetti-Nissen fundoplication is the potential for creating a two compartment (“bilobed”) stomach, which requires reoperation to correct.⁶

It might be argued that the greater incidence of dysphagia seen with the Rosetti-Nissen fundoplication in this study resulted from the “learning curve,” because the “floppy” Nissen fundoplication was not performed early in our experience, during the multicenter trial. In fact, if one excludes the first 28 operations, the differences in solid food dysphagia between the three procedures remain statistically significant. These observations have caused us to abandon the Rosetti-Nissen fundoplication.

The Toupet fundoplication was viewed favorably in our previous study because of diminished postoperative dysphagia when compared with Rosetti-Nissen fundoplication.^{3,18} Currently, it is clear that an equally low incidence of dysphagia may be achieved with Nissen and

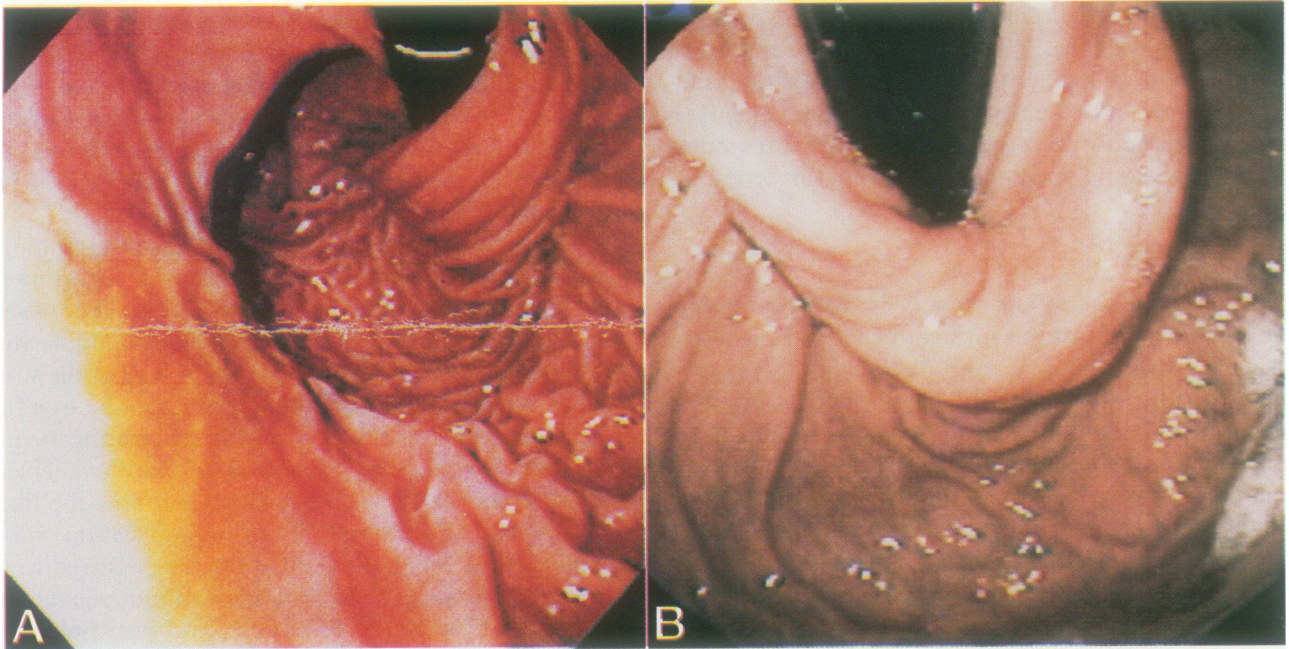


Figure 4. Endoscopic appearance of a "spiral valve" after a Rosetti-Nissen fundoplication in a patient with post-operative dysphagia (A) and appearance of a normal valve after a "floppy" Nissen fundoplication (B).

Toupet fundoplication if the fundus is adequately mobilized and a "floppy" fundoplication is performed. Long-term follow-up data on the Toupet fundoplication are lacking, but short-term follow-up data from France and long-term follow-up data on another subtotal fundoplication, the Belsey fundoplication, suggest that subtotal fundoplication may provide less durable protection from reflux than standard Nissen fundoplication.^{19,20} Also, the Toupet fundoplication takes 15 to 30 minutes longer to perform because of additional suturing. For these reasons, we reserve this operation for patients with profound disorders of esophageal motility, in whom 360° fundoplication occasionally has resulted in severe persistent dysphagia.²¹

Many surgeons are reluctant to mobilize the gastric fundus laparoscopically because of fear of bleeding, splenectomy, or increased operative time. These were our initial fears as well. Although we certainly increased the duration of the operation (by 45 minutes initially, and 20 minutes currently), we did not see an increased rate of splenic or gastric injury, and significant bleeding was rare during a careful dissection of the fundus.

Perhaps these data would seem more significant if the patients were assigned randomly to one of the three procedures, rather than allowing the surgeon to decide which procedure to perform.

We believe that it would be inappropriate to randomize all patients, including those with a small gastric fundus, to a comparison of the Rosetti-Nissen fundoplication and the "floppy" Nissen fundoplication because the

incidence of severe, refractory dysphagia would be excessive in the Rosetti-Nissen group when the fundus was small. By assigning only patients with the greatest fundus redundancy to the Rosetti-Nissen procedure, we effectively "stacked the deck" in favor of Rosetti-Nissen fundoplication. The finding of a significantly greater rate of dysphagia in these patients was a great surprise. Similar to this trial the observations made by careful prospective *nonrandomized* audits of technique have made more impact on surgery for gastroesophageal reflux disease in the last decade than the few randomized trials pitting one technique against another.^{11,14,17,18}

Mild transient solid food dysphagia, occurring as a result of laparoscopic fundoplication, is an unavoidable side effect of operation; however, severe persistent dysphagia probably is due to poor patient selection, inadequate preoperative evaluation, or technical error. Post-operative dysphagia may be minimized, without compromising control of gastroesophageal reflux, by mobilizing the fundus of the stomach and performing a short (1–2 cm) fundoplication over a large dilator (56–60 French).

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