

Early Experience with Laparoscopic Nissen Fundoplication

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Studies of the natural history of gastroesophageal reflux disease (GERD) indicate that most patients have limited disease responsive to simple lifestyle, dietary and medical therapy and do not go on to develop complications.¹ Thus the majority of patients manifest a relatively benign form of the disease and do not need antireflux surgery. Indeed, expanding the indications for surgery to include patients with lesser forms of the disease will only serve to lessen the overall rate of successful surgery. However, approximately 25% of the patients with GERD will develop recurrent or progressive disease.¹ It is this population of patients that is best suited to surgical therapy. Although at present there is no reliable method to identify which patients will develop progressive disease, there are several factors that predispose patients to complications and failure of medical therapy. These factors should be identified early in the course of therapy and taken into account when considering therapeutic alternatives.

SELECTION OF PATIENTS FOR SURGERY

Traditionally antireflux surgery has been reserved for patients refractory to medical therapy or with end-stage disease and disabling symptoms. The surgeon often encountered the patient after years of medical treatment usually with anatomic and physiologic conse-

quences of long-standing disease such as esophageal shortening, stricture formation, and peristaltic failure. Successful antireflux surgery in this setting is a particular challenge.

The advent of laparoscopic fundoplication has almost certainly lowered the threshold for consideration of antireflux surgery for both the patient and physi-

cian. Young patients with documented reflux disease and a defective lower esophageal sphincter are now considered excellent candidates for antireflux surgery. Patients with a mechanically incompetent lower esophageal sphincter typically do not respond well to medical therapy, usually developing recurrent symptoms within one to two



Figure 1. Patient positioning and trocar placement for laparoscopic antireflux surgery. The patient is placed with the head elevated 45 degrees in the modified lithotomy position. The surgeon stands between the patients' legs and the procedure is completed via five abdominal access ports.

years of the onset of therapy.² This suggests that patients with deficient lower esophageal sphincters do not respond well to medical therapy, often relapse, and should be considered for an antireflux operation, irrespective of the presence or absence of endoscopic esophagitis. Indeed, we are cautious about performing fundoplication in patients with a normal lower sphincter. Such patients are often "upright" refluxers who are chronic air swallows and do not do as well following antireflux surgery.

Esophagitis in a symptomatic patient with a mechanically defective lower esophageal sphincter should raise the question of surgical therapy. These patients are also prone to relapse of their symptoms while receiving medical therapy.³ The development of a stricture represents a failure of medical therapy and is an indication for an antireflux procedure. In addition it is usually associated with loss of esophageal contractility.⁴ Prior to surgery, a malignant etiology of the stricture should be excluded and the

stricture progressively dilated up to a 60 Fr. bougie. When fully dilated, the relief of dysphagia is evaluated and esophageal manometry is performed to determine the adequacy of peristalsis in the distal esophagus. If dysphagia is relieved and the amplitude of esophageal contractions is adequate, an antireflux procedure should be performed. If the amplitude of esophageal contractions is poor, caution should be exercised in performing a complete fundoplication; a partial fundoplication is generally considered more appropriate.

Barrett's columnar-lined esophagus is almost always associated with a severe mechanical defect of the lower esophageal sphincter and often poor contractility of the esophageal body.^{5,6} Patients with Barrett's esophagus are at risk of progression of the mucosal abnormality up the esophagus, formation of a stricture, hemorrhage from a Barrett's ulcer, and the development of an adenocarcinoma.⁷ A surgical antireflux procedure may arrest the progression of the disease, heal ulceration, and resolve strictures.⁸ If on mucosal biopsies severe dysplasia or intramucosal carcinoma is found, an esophageal resection should be done.⁹

In summary, the majority of patients requiring treatment will have a relatively mild form of disease and will respond to antisecretory medications. Patients with more severe forms of disease, particularly those with risk factors predictive of medical failure, or those who develop recurrent or progressive disease, should be considered for early definitive therapy. Laparoscopic Nissen fundoplication will provide a long-term cure in the majority of these patients, with minimal discomfort, and an early return to normal activity. Patients who present with long-standing disease associated with poor esophageal function, a short esophagus, or stricture formation should undergo an open antireflux procedure tailored to their underlying anatomical and physiologic abnormalities. Finally, if the disease has progressed to frank esophageal failure, dysplastic Barrett's metaplasia, or esophageal adenocarcinoma, an esophagectomy will likely be required.

REQUIREMENTS FOR ANTIREFLUX SURGERY

The requirements for laparoscopic antireflux surgery are identical to its

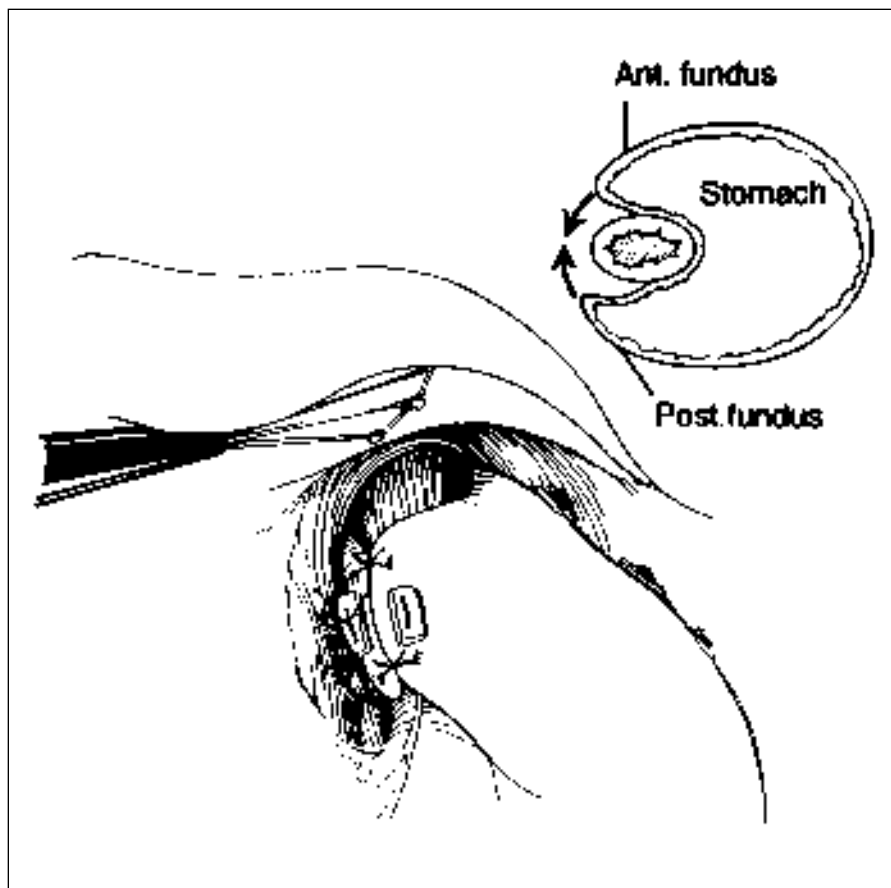


Figure 2. Fixation of the fundoplication. (2a) The fundoplication is sutured in place with a single U-stitch of 2-0 Prolene pledgeted on the outside. A 60 Fr. mercury-weighted bougie is passed through the gastroesophageal junction prior to fixation of the wrap to assure a floppy fundoplication. (2b) Inset illustrates the proper orientation of the fundic wrap.

open counterparts and include the following:

1. Documentation of pathologic esophageal acid exposure on 24-hour pH monitoring.
2. A mechanically deficient lower esophageal sphincter.
3. Normal esophageal contractility.
4. Normal esophageal length.

Our experience suggests that in approximately 65% of patients referred for surgery, a transabdominal laparoscopic Nissen fundoplication is the most suitable treatment. The remaining 35% of patients are best treated with an antireflux procedure tailored to their underlying abnormalities. This approach results in excellent long-term relief of reflux symptoms across the whole spectrum of disease.

TECHNIQUE OF LAPAROSCOPIC NISSEN FUNDOPPLICATION

The essential elements necessary for the performance of a transabdominal fundoplication are common to both the laparoscopic and open procedures and include the following:

1. Crural dissection, identification, and preservation of both vagus nerves and the hepatic branch of the anterior vagus nerve.
2. Circumferential dissection of the esophagus.
3. Crural closure.
4. Fundic mobilization by division of short gastric vessels.
5. Creation of a short, loose fundoplication by enveloping the anterior and posterior wall of the fundus around the lower esophagus.

Laparoscopic fundoplication has become commonplace and may soon replace traditional open Nissen fundoplication as the procedure of choice.^{10,11}

Five 10-mm ports are utilized (Fig. 1). Dissection is begun by incision of the thinned portion of the gastrohepatic omentum above the hepatic branch of the anterior vagal nerve. The diaphragmatic crura are dissected and the esophagus is mobilized by careful dissection of the anterior and posterior soft tissues within the hiatus. The esophagus is held anterior and to the left and the crura approximated with three to four interrupted 0-silk sutures, starting just above the aortic decussation and working anterior. Complete fundic mobilization allows construction of a tension-free fundoplication. Short gastric vessels are sequentially dissected and divided. Following complete mobilization of the fundus, the posterior wall of the fundus is gently brought behind the esophagus to the right side. The anterior wall of the fundus is brought anterior to the esophagus, and the fundic lips are manipulated to allow the fundus to envelop the esophagus without twisting (Fig. 2). A 60 Fr. bougie is passed to size the fundoplication properly, and it is sutured utilizing a single U-stitch of 2-0 Prolene (Ethicon, Inc.) buttressed with felt pledgets.

The advent of the laparoscopic approach provides an ideal opportunity for standardization of the technique of Nissen fundoplication. Considerable controversy continues regarding technical aspects of the procedure, including the need for crural closure and fundic mobilization. Although there are no prospective randomized studies documenting the benefit of these technical details, experience is beginning to show their benefit. Failure to re-approximate the diaphragmatic crura has been suggested as the cause of paraesophageal and recurrent sliding

hiatal herniation post-fundoplication.¹² Dallemagne et al. have recently reviewed the reasons for failure in their first 535 patients.¹³ The most common etiology of postoperative dysphagia was the performance of a Rosetti-Hell modification of the Nissen procedure in which the short gastric vessels are not divided. Others have also noted an increased incidence of postoperative dysphagia in patients without fundic mobilization.^{14,15} Similar observations were made in the era of open antireflux surgery, particularly when considering the reasons for failure of a primary antireflux procedure. The laparoscopic experience is thus beginning to reconfirm the wisdom of careful technique.

RESULTS

A number of early studies reporting the safety and efficacy of laparoscopic fundoplication have now been published.^{10,11,15-18} In general, these reports document control of symptoms in 80% to 90% of patients with acceptably low morbidity and conversion rates to laparotomy (Table 1). Weerts and Dallemagne reported an analysis of 132 patients undergoing laparoscopic fundoplication in 1991 and 1992.¹⁰ There was no mortality, and the morbidity rate was 7.5%. Good to excellent results were achieved in 94% of patients. Of the 98 patients seen in follow-up, more than three months after surgery 5 (5.4%) complained of dysphagia, but whether it was persistent or induced was not specified. Cuschieri and colleagues from the United States reported 116 patients undergoing laparoscopic antireflux surgery.¹⁵ Both partial (Toupee) and complete (Rosetti-Hell modification of Nissen) fundoplications

Table 1. Literature series of laparoscopic fundoplication

Series	N	Conversion (N)	Reoperation (N)	Excellent/Good Results	Morbidity	Dysphagia (>3 mos.)
Weerts & Dallemagne ¹⁰	132	4	1	93%	7.5%	5.0%
Cuschieri ¹⁵	116	1	0	91%	13.0%	7.0%
Bittner & Pappas ¹⁶	35	5	0	87%	25.7%	24.0%
Hinder & Jamieson ¹⁷	155	19	7	89%	9.0%	5.0%
Hinder & Filipi ¹⁸	198	6	3	97%	4.0%	6.0%
Peters & DeMeester ¹⁹	34	1	0	84%	17.6%	9.4%
Total:	634	36 (5.7%)	11 (1.8%)	89%	10.7%	9.49%

were used. Excellent to good results were seen in 85% of those patients having a complete fundoplication. Bitter and Pampas published the first report of laparoscopic fundoplication from this country with less encouraging results.¹⁶ Postoperative complications occurred in 13% of the 30 patients completing the laparoscopic procedure. Excellent to good symptomatic results were seen in 87%. Jamieson recently reported his initial experience with laparoscopic fundoplication.¹⁷ He used the Rosetti-Hell modification of Nissen's procedure and did not take down short gastric vessels. Good results were

achieved in 89% of patients, although his rate of conversion to laparotomy was 12%. Seven percent of patients required re-operation within six months of their laparoscopic procedure. Eight percent of his patients were either re-operated upon for dysphagia, or continue to complain of dysphagia at one year after the procedure. Taken together these studies report a slightly higher incidence of persistent dysphagia than accepted with open Nissen fundoplication in recent years. The fact that the follow-up is short and that most reports represent the initial patients undergoing this new procedure would indicate that

the incidence of dysphagia will decrease with experience as technical modifications are made to avoid inducing the problem.

We have recently compared the clinical and physiologic outcome of open and laparoscopic Nissen fundoplication.¹⁹ Our study showed that the symptomatic outcomes are similar with over 85% of patients completely asymptomatic following either procedure. Physiologic studies suggested that laparoscopic fundoplication resulted in a somewhat greater augmentation of the lower esophageal sphincter pressure than did open fundoplication (Fig. 3). Whether this is due to a "learning" curve of the technique remains to be established. Both open and laparoscopic procedures were highly effective in controlling acid reflux (Fig. 4).

Widespread application of laparoscopic Nissen fundoplication in all patients without objective assessment of deficits in esophageal length or function will lead to poor results in a significant number of patients with advanced disease. Patients with gastroesophageal reflux disease are often treated medically for years prior to referral for antireflux surgery, and are apt to have anatomic and functional consequences of long-standing reflux disease. Published studies would suggest that failure to tailor the operation appropriately in patients with late-stage disease results in a high percentage of poor outcome.²⁰⁻²³ For these reasons we have advocated the importance of tailoring the type of antireflux repair to the alterations in esophageal function and length seen over a wide spectrum of disease.²⁴ The options include a laparoscopic Nissen fundoplication, a transthoracic Nissen fundoplication, or a transthoracic Belsey partial fundoplication with or without esophageal lengthening procedures. We have selected patients with documented reflux and an incompetent sphincter who retain normal esophageal body function and length for laparoscopic fundoplication. In our experience this includes approximately 65% of patients referred for surgery. The remaining 35% are selected for an open antireflux procedure tailored to their underlying abnormalities, usually a Belsey or Collis-Belsey procedure. This approach has results in excellent long-term relief of reflux symptoms across the whole spectrum of disease. Consequently,

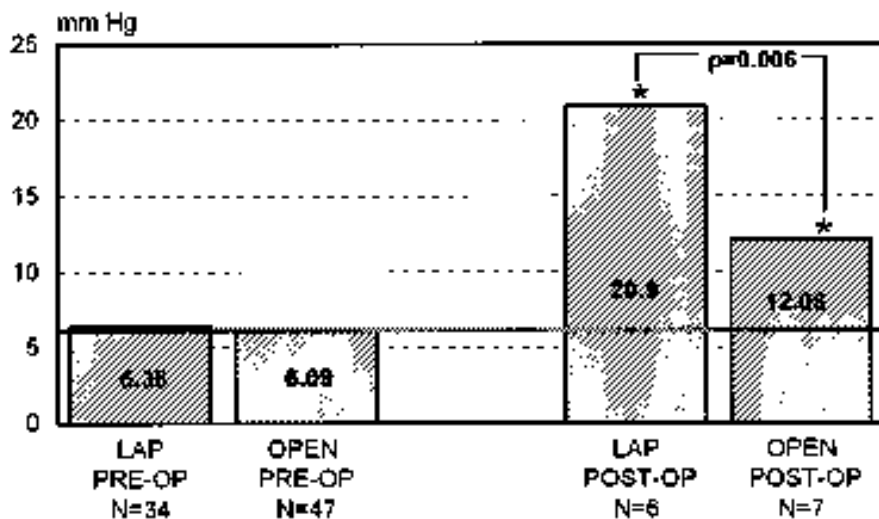


Figure 3. Mean lower esophageal sphincter pressures before and after open and laparoscopic fundoplication. The line indicates the fifth percentile value for 50 normal volunteers (6 mm Hg). (* $p < 0.05$ versus preoperative values; from Peters JH, Heimbucher J, Incarbone R, et al. Clinical and physiologic comparison of laparoscopic and open Nissen fundoplication. *J Am Coll Surg* 1995;180:385-93.)

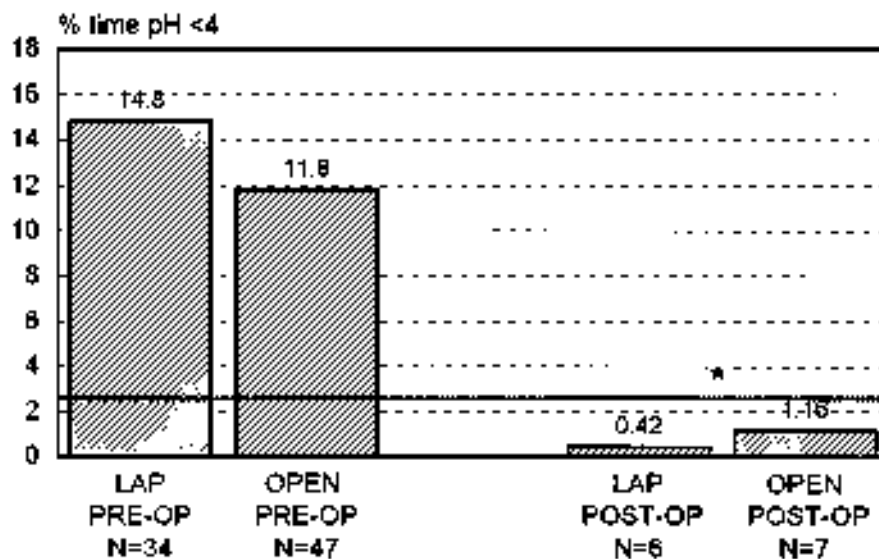


Figure 4. Mean time of pH less than 4 on 24-hour esophageal pH monitoring before and after laparoscopic and open fundoplication. The line indicates the fifth percentile for 50 normal volunteers (4.3%). (* $p < 0.05$ versus preoperative values; from Peters JH, Heimbucher J, Incarbone R, et al. Clinical and physiologic comparison of laparoscopic and open Nissen fundoplication. *J Am Coll Surg* 1995;180:385-93.)

physiologic assessment prior to antireflux surgery becomes particularly important with the growing enthusiasm for minimally invasive techniques. **STI**

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