SURGICAL THERAPY FOR GERD

Thomas J. Watson, MD, FACS

Division of Thoracic and Foregut Surgery, Department of Surgery, University of Rochester School of Medicine and Dentistry, Rochester, New York, USA

Introduction

Surgical therapy for GERD has been revolutionized by the introduction of laparoscopic fundoplication in the early 1990s. The indications for surgery, preoperative evaluation, and techniques of fundoplication have been refined, leading to generally favorable outcomes as assessed by both subjective and objective parameters. The introduction of a minimally invasive approach to fundoplication, coupled with the excellent long-term control of symptoms afforded by such procedures, has made antireflux surgery an attractive alternative. On the other hand, the potential morbidity and cost of surgery, as well as poor short or long-term outcomes occurring in a subset of patients undergoing antireflux procedures (ARPs), has led to criticism regarding the efficacy of fundoplication and a constantly evolving list of alternative medical or endoscopic treatments for GERD. Recent data suggest that the peak use of antireflux surgery in the U.S. occurred in 1999, with an estimated 15.7 cases per 100,000 adults at that time. Since then, the frequency of antireflux surgery has declined, such that an estimated 11 ARPs were performed per 100,000 adults in 2003. This recent decline may reflect the availability of over-the-counter proton pump inhibitors (PPIs), the increasing adoption of endoscopic antireflux therapies, and the efficacy of fundoplication being called into question. Given the various therapies for GERD, each with its potential advantages and shortcomings, accurate and current data regarding outcomes after
antireflux surgery are necessary as a basis against which other established and novel therapies must be judged.

**Indications**

**Symptom Assessment**

The evaluation for antireflux surgery commences with a complete history emphasizing the patient’s reflux symptoms and response to antisecretory and promotility therapy. The presence of both “typical” reflux symptoms, such as heartburn, regurgitation or dysphagia, as well as “atypical” symptoms which might be attributable to GERD, such as cough, wheezing, hoarseness, shortness of breath, or sore throat is noted. Because there are fewer potential mechanisms for their generation, typical symptoms are more likely to be secondary to increased esophageal acid exposure than are atypical symptoms.

The relationship of atypical symptoms to heartburn or regurgitation should be established as well. Other common contributors to respiratory symptoms should be investigated, such as smoking, postnasal drip, asthma or the use of angiotensin converting enzyme (ACE) inhibitors. The chest radiograph should be assessed for evidence of associated lung parenchymal abnormalities. The patient must be made aware of the relatively diminished probability of success of antireflux surgery when atypical symptoms are the primary factors driving intervention, in that these other contributors may remain. Of importance is the relatively long time frame necessary for respiratory symptoms to improve after surgery compared to typical symptoms [ ].

Symptomatic response to acid suppression medications is of importance as it can predict relief following surgery[^4]. A paradox of patient referral for antireflux surgery is
that patients well-controlled on medical therapy, who may be amongst the best candidates for surgery, often are not considered for surgical therapy, while those who do not respond to medical therapy and, therefore, may not respond well to surgery, often are sent for a surgical opinion. A detailed objective evaluation for the presence of pathologic gastroesophageal reflux is particularly important in the latter group, as well as a careful determination of whether the patient’s main complaints are likely reflux-related. The surgeon needs to be aware of primary symptoms such as nausea, early satiety, epigastric pain or bloating that may be indicative of foregut pathology and may even occur in the presence of pathologic esophageal acid exposure, though may not be caused by gastroesophageal reflux \textit{per se}.

Additional historical factors of interest include the presence of asthma, other pulmonary disease (e.g. recurrent aspiration/pneumonia, “idiopathic” pulmonary fibrosis or interstitial lung disease), concomitant cardiac disease, exercise tolerance and prior surgical procedures involving the abdomen, chest or neck. Physical examination should include the patient’s body habitus and weight, detailed assessment of the lungs, documentation of surgical scars, as well as an overall assessment of functional status. Obesity and extensive prior upper abdominal surgery are relative indications for a transthoracic approach to fundoplication in the hands of some surgeons, whereas a thoracotomy is generally avoided in the elderly or patients of poor functional status. In the setting of morbid obesity, whether fundoplication or a bariatric procedure such as Roux-en-Y gastric bypass is the preferable operation for control of reflux is a matter of ongoing study. Many surgeons favor the latter option because of concerns about the
durability of a fundoplication in the setting of morbid obesity as well as the multiple non-
GERD-related health benefits derived from weight loss following gastric bypass.

Anatomic Factors

In addition to patients who are severely symptomatic from GERD, other patients
commonly referred for consideration of antireflux surgery are those with a
paraesophageal hernia or intrathoracic stomach.

The traditional recommendation, dating back to a landmark manuscript by
Skinner and Belsey from 1967⁵, was to repair all such large hernias at the time of
diagnosis. In that report, the risk of fatal complications from an untreated paraesophageal
hernia was stated to be approximately 28% over the patient’s lifetime. With increasing
experience, however, the observation has been made that the risks of leaving
asymptomatic paraesophageal hernias uncorrected is not nearly that high⁶. In addition,
the repair of such hernias is not without risk of morbidity or mortality, especially in light
of the demographics of this condition. Patients presenting with paraesophageal hernias
are commonly elderly, kyphotic and with significant comorbidities. Finally, the long-
term success rate of repair of large hernias is not as good as following repair of smaller,
sliding hiatal hernias or after operation for GERD without an associated hiatal hernia.
This fact deserves emphasis, in that the outcomes of all patients undergoing
fundoplication tend to be lumped together in the mind of the referring physician. Many
centers, including ours, are seeing an increasing proportion of patients with
paraesophageal hernias referred for fundoplication. The surgical results in this elderly
patient cohort with more associated comorbidities and worse anatomic considerations
should not be extrapolated to the entire population of patients undergoing fundoplication for control of GERD.

Another point worthy of emphasis is that most trials of endoscopic therapies for GERD have excluded cohorts of patients presenting with symptomatic, functional or anatomic factors that might preclude effective reflux control through such an approach. Trials of endoscopic therapy have, by and large, included only study subjects with uncomplicated GERD and typical symptoms of heartburn and regurgitation that have responded to medical therapy. Patients with severe anatomic derangements, such as esophageal strictures, persistent esophagitis, Barrett’s esophagus, or significant hiatal hernias, as well as those with severe motility disorders or significant comorbidities, are excluded from such clinical trials. Similarly, patients who have demonstrated a poor response to medical therapy and those with primarily extraesophageal manifestations of GERD have not been studied. These factors must be kept in mind as one compares outcomes following an ARP to those reported with endoscopic therapies; the patients expected to have the worst outcomes generally are excluded from trials of endoscopic treatment.

Surgical techniques

The concept of a fundoplication was first introduced by Rudolph Nissen in 1955. Since then, a number of operations and approaches (both transabdominal and transthoracic) have been utilized. With the introduction of laparoscopic Nissen fundoplication by Dallémagne in 1991, the surgical treatment of GERD was revolutionized and utilization dramatically increased over the ensuing years [2]. All operations to control GERD are intended to restore competency of the LES and correct an
associated hiatal hernia, if present. Despite universal agreement upon these basic goals, the exact details of operative intervention remain controversial. Areas of ongoing debate include:

1) The optimal surgical approach (laparoscopic, open transabdominal, transthoracic) in specific circumstances (e.g. redo operations, morbid obesity, large paraesophageal hernias);
2) The need for division of the short gastric vessels to allow adequate fundic mobilization;
3) The circumferential extent of fundoplication, positioning (anterior or posterior) and length;
4) The need for bougie placement during fundoplication;
5) The tightness of hiatal closure and how this is assessed;
6) The manner in which esophageal body shortening is determined and corrected;
7) Whether the fundic wrap requires fixation in the peritoneal cavity and how this is achieved;
8) Whether hiatal reinforcement with prosthetic or biologic mesh is an important adjunct, particularly in the setting of repair of paraesophageal hernias.

A complete description of the various operative techniques is beyond the scope of this manuscript, though a number of authoritative descriptions already exist.

Outcomes

Much has been written about outcomes after antireflux surgery. Any discussion regarding results following fundoplication must consider:

1) Perioperative morbidity and mortality;
2) Side-effects;

3) Control of typical and atypical symptoms;

4) Objective relief from excessive esophageal acid exposure;

5) Anatomic failure rates, such as recurrent hiatal herniation or slippage, and the need for reoperation.

**Perioperative morbidity/mortality**

Laparoscopic fundoplication is a safe procedure in experienced hands and in appropriately selected patients. Mortality is rare following fundoplication, generally far less than 1%, and with current estimates being in the range of 1 to 2 per 1000 operations. Intraoperative complications also are rare and generally minor, including pneumothorax, subcutaneous emphysema, small liver or splenic lacerations and gastric serosal tears. Major complications are infrequent and include esophageal or gastric perforations (most of which can be readily repaired), inadvertent vagotomy, trocar injuries to bowel or vascular structures, and aortic injury from needle puncture (which generally can be controlled with pressure applied to the region for 5-10 minutes.) In the early postoperative period, relatively common complications include atelectasis or urinary retention. Pneumonia and respiratory failure are rare except in high-risk individuals. Wound infections are infrequent and incisional hernias are increasingly rare with improvements in technique. Acute paraesophageal herniation of the fundic wrap can occur and, although rare, generally requires expeditious reoperation.

**Side effects**

Some degree of side effects after surgery is common. Short-term dysphagia is an anticipated outcome, limiting solid food intake for a period of weeks to a few months
following fundoplication. Significant dysphagia beyond 6 months, and of worse severity than the patient experienced before surgery, is uncommon, occurring in the range of 3-5% of cases. When dysphagia exists before surgery, it improves more often than not following surgery. Other possible post-fundoplication symptoms include bloating, difficulty with belching or vomiting, gassiness, hyperflatulence, early satiety, nausea and diarrhea.

**Relief of primary symptoms**

Multiple retrospective and non-randomized surgical series have demonstrated relief of heartburn and regurgitation in approximately 88-95% of patients in short to medium-term follow-up after laparoscopic fundoplication [ ]. As laparoscopic Nissen fundoplication (LNF) was first reported in 1991, outcomes data after 10 or more years of follow-up have only recently appeared in the literature.

A review from a single center in Belgium, where the first LNF was performed, showed that of 100 consecutive patients undergoing a LNF in 1993, 93% were free of significant reflux symptoms at 5 years after surgery and 89.5% were still symptom-free at 10 years.

Another recent review of a single-center experience from the U.S. reported outcomes from 239 patients undergoing LNF at least 10 years prior. Eighty-five per cent of patients reported their preoperative GERD symptoms to be almost completely resolved or greatly improved after surgery, and 85% reported that they would undergo LNF again if given the choice.

Only a few randomized trials have compared open and laparoscopic fundoplication with outcomes data at 5 years or beyond. A single institution, prospective, randomized
trial from Sweden comparing LNF to conventional Nissen fundoplication (CNF) was reported in 2004\textsuperscript{14}. At a follow-up of 5 years, no differences were found between the two groups in subjective outcomes including diet, sleep, medication usage, patient satisfaction and symptoms of GERD. Well-being was increased back to, or above, normal values in both groups following surgery. LNF led to a shorter hospital stay, less need for perioperative analgesics, better respiratory function and improved cosmesis, consistent with other reports.

The results of a multicenter, randomized trial from the Netherlands comparing LNF to CNF with follow-up 5 years after surgery was recently reported\textsuperscript{15}. When comparing 79 patients undergoing LNF to 69 patients undergoing CNF, no significant differences were observed in subjective outcome, with overall satisfaction rates of 88\% and 90\%, respectively. Also, no differences were observed in outcomes at 3 to 6 months after surgery compared to those at 5 years after surgery.

The results of a prospective, randomized study of laparoscopic and open Nissen fundoplication from a single center in Finland provided outcomes data at a median follow-up of over 11 years\textsuperscript{16}. Forty-nine patients were available for follow-up in the laparoscopic group and 37 patients in the open group. Late subjective results, including control of GERD-related symptoms and satisfaction with surgery, were excellent and similar between the two groups. In the entire cohort, 85.4\% of patients rated their surgical result as excellent, good or satisfactory. When asked whether they would choose surgery again, 73.7\% of patients in the open group and 81.8\% in the laparoscopic group said they would.
While several reports, including one highly publicized Veterans Administration study\(^{17}\), have suggested that a significant percentage of patients resume taking acid suppressive medications after an antireflux procedure, other reports have shown contrary results or that the majority of such patients do not, in fact, have recurrent GERD\(^{18-20}\). Resumption of medications, therefore, should not be equated to the failure of surgery or the return of GERD.

The ability to control the “atypical” or extraesophageal manifestations of GERD tends to be somewhat less reliable following antireflux surgery, given the multiple triggers other than GERD that are potentially etiologic. Multiple prospective and retrospective, randomized and non-randomized studies suggest an approximately 70% success rate at improving cough, asthma or laryngitis following an antireflux procedure\(^{21-24}\).

**Objective outcomes**

The ability of an antireflux operation to restore esophageal acid exposure to normal depends upon the type of fundoplication performed. Complete (Nissen) fundoplications generally are more reliable and durable than partial (e.g. Toupet) fundoplications at preventing pathologic acid reflux. Objective studies have shown that more than 90% of patients will have normal pH studies at 1-3 years following complete fundoplication, whereas only 50% of patients will have normal esophageal acid exposure following a partial fundic wrap\(^{25}\).

Objective outcomes following fundoplication have been assessed in different manners. The gold standard for assessment of reflux control, ambulatory esophageal pH monitoring, is difficult to obtain in the postoperative setting, in that satisfied and
asymptomatic patients after fundoplication generally are reluctant to undergo the study. In the Swedish study comparing LNF and CNF, pH data were available on 16 patients undergoing LNF and 22 patients undergoing CNF at both 6 months and 5 years after surgery\textsuperscript{14}. Esophageal acid exposure returned to normal at both time points in all patients tested with no significant difference between the two groups. In the multicenter trial from the Netherlands, pathologic esophageal acid exposure was found in 12.5\% of patients following LNF and 4.1\% following CNF at 5 years after surgery\textsuperscript{15}.

**Anatomic failure**

An important, and often underemphasized point, is that the rate of failure of fundoplication is largely dependent upon the size of the hiatal hernia being repaired. Repair of large sliding and paraesophageal hernias (PEH) is associated with a higher risk of recurrent hiatal herniation compared to fundoplication for GERD in the setting of no or small hiatal hernias. Multiple potential explanations exist to explain this differential, including the presence of a widened hiatus with weakened or attenuated crural fibers that must be brought together under tension, the coexistence of esophageal body shortening, the generally older and frailer nature of patients with a PEH, and underlying anatomic or connective tissue deficits that contributed to the pathogenesis of the hernia.

The need for reoperation after fundoplication for GERD is only approximately 5\% over the patient’s lifetime, whereas the risk can run as high as 42\% after repair of a giant PEH\textsuperscript{26}. In the trial from Finland, objective outcomes were assessed by endoscopy and demonstrated a 40\% disruption rate following CNF, though a 13\% disruption rate following LNF\textsuperscript{16}. Despite these relatively high rates of objective breakdown, only 8\% of
patients in the open group, and 2% in the laparoscopic group, had undergone repeat operation for fundoplication failure.

A recent trial compared two techniques of laparoscopic PEH repair, with or without the use of a biologic prosthesis placed at the esophageal hiatus\textsuperscript{27}. At 6 months, 9% of patients with the prosthesis and 24% of patients without mesh reinforcement had developed a recurrent hiatal hernia as assessed by a barium upper gastrointestinal examination, underscoring the potential for failure when operation is undertaken for PEH.

Some surgeons routinely add a Collis gastroplasty as an esophageal lengthening procedure in the setting of fundoplication for giant PEH given the high incidence of acquired esophageal body shortening associated with this condition\textsuperscript{28}. Methods to reduce the risk of recurrent hiatal herniation following repair of giant PEH, such as gastroplasty, mesh reinforcement, extensive esophageal mobilization or use of open surgical approaches rather than laparoscopy, are areas of active ongoing investigation.

**Conclusions**

Antireflux surgery has become well-established as an effective and durable therapy for gastroesophageal reflux disease and its complications. The popularization of minimally invasive surgical techniques has brought about a revolution in the availability and desirability of surgical procedures for long-term management of GERD. The outcome of antireflux surgery, however, is only as good as the evaluation to document the presence of pathologic reflux and associated abnormalities in the foregut, as well as the determination that the patient’s main symptoms are, in fact, reflux related. Established and novel foregut diagnostics continue to be refined and aid in the
preoperative investigation of GERD. Surgical techniques similarly continue to be refined as our understanding of both short-term and long-term symptomatic and objective outcomes matures. With experience and innovation, our collective understanding of the pathophysiology of gastroesophageal disease will increase, and our ability to manage the diverse manifestations of foregut disorders undoubtedly will improve. The utility of fundoplication compared to medical therapy and evolving endoscopic therapies for GERD will undergo ongoing scrutiny, and the relative indications and contraindications for each type of approach will be further elucidated.