Hypothesis: Laparoscopic anterior 180° partial fundoplication provides good long-term relief for symptoms of gastroesophageal reflux disease and is associated with few adverse effects.

Design: Prospectively evaluated case series.

Setting: University teaching hospital.

Patients: The late clinical outcome was determined for all patients who had undergone a laparoscopic anterior 180° partial fundoplication by us between August 1, 1993, and November 30, 1999.

Interventions: Long-term (≥5 years’) follow-up after laparoscopic anterior 180° partial fundoplication was obtained using a structured questionnaire.

Main Outcome Measures: Overall satisfaction and the symptoms of heartburn and dysphagia were assessed using analog scales, and the presence or absence of other adverse outcomes was also determined.

Results: One hundred seventeen procedures were performed. The outcome at 5 to 11 years’ (mean, 6.4 years’) follow-up was determined for 113 patients (97%). Twelve patients (11%) died of unrelated causes during follow-up, and 1 patient underwent esophagectomy. Further surgery was undertaken in 12 patients (11%): 8 for recurrent reflux, 3 for a symptomatic hiatal hernia, and 1 for dysphagia. For 100 patients with clinical outcome data at late follow-up, gastroesophageal reflux symptoms were significantly improved following surgery and were well controlled in 80 patients. The incidence and severity of dysphagia were reduced after surgery. Normal belching was preserved in 91 patients, and almost all patients were able to eat normally. The overall outcome of surgery was rated as satisfactory, with 95 patients reporting that they considered their original decision to undergo surgery correct.

Conclusions: Laparoscopic anterior 180° partial fundoplication is an effective procedure for the surgical treatment of gastroesophageal reflux and is associated with a high rate of patient satisfaction at late follow-up. Compared with Nissen fundoplication, however, it is likely to be associated with a higher risk of recurrent reflux, although this is balanced by a lower rate of adverse effects.
reported the outcome for a cohort of patients who underwent a laparoscopic Nissen fundoplication 5 to 8 years earlier. In that study, the outcome was determined for 99% of the study cohort. We also reported 5-year outcomes from 2 randomized trials with similar rates of follow-up. One of those studies compared anterior 180° partial fundoplication with Nissen fundoplication, with the results suggesting advantages for the partial fundoplication procedure at 5 years. Nevertheless, the long-term efficacy of anterior 180° partial fundoplication remains under scrutiny, and it is important to determine and report the long-term outcome. In the present study, we determined the outcome for a larger group of patients who had undergone a laparoscopic anterior 180° partial fundoplication procedure at least 5 years earlier.

METHODS

Since commencing laparoscopic antireflux surgery in 1991, all of our patients undergoing this procedure have been followed up prospectively. Clinical data have been stored in a database, which was used to identify patients who had undergone a laparoscopic anterior 180° partial fundoplication at least 5 years earlier. These patients underwent surgery between August 1, 1993, and November 30, 1999, primarily at the Royal Adelaide Hospital and associated private hospitals in Adelaide, Australia. The operative technique for laparoscopic anterior 180° partial fundoplication has been described in detail previously. It entails laparoscopic hiatal dissection, posterior hiatal repair, and suturing of the anterior wall of the gastric fundus and the right lateral wall of the distal esophagus to the right hiatal pillar and the apex of the esophageal hiatus, to stabilize a length of intra-abdominal esophagus and to cover the anterior aspect of the intra-abdominal esophagus with the gastric fundus.

During the study, all patients who underwent a primary antireflux procedure were treated with a laparoscopic approach to fundoplication, irrespective of any perceived difficulties at preoperative assessment such as obesity, large hiatal hernia, previous upper abdominal surgery, esophageal stricture, or Barrett esophagus. Esophageal manometry was performed before surgery in all patients. Some patients were selected to undergo an anterior 180° partial fundoplication because they had poor esophageal motility, some underwent the procedure as part of a previously reported randomized trial, and others specifically selected the procedure. Most patients who did not undergo an anterior 180° partial fundoplication underwent a laparoscopic Nissen procedure. More than 90% of the patients underwent surgery because of troublesome reflux symptoms that were not adequately controlled with standard acid-suppression medication.

Preoperative, operative, and postoperative outcome data for each patient were collected prospectively and stored in a computerized database (FileMaker Pro, Version 5.5, FileMaker, Inc, Santa Clara, Calif). Postoperative clinical follow-up information was obtained by using a standardized questionnaire, which was administered by a research nurse at 3 months and then yearly after surgery. This questionnaire was initially mailed to each patient. If the questionnaire was not returned, it was sent a second time. If the second follow-up attempt failed, further attempts were made to locate the patient so that data could be collected by telephone interview using the same structured questionnaire. A concerted effort was made to obtain follow-up information for every patient who had undergone surgery, in an attempt to achieve complete follow-up.

The presence or absence of heartburn, dysphagia for liquids, and dysphagia for solid food were assessed using 0-to-10 visual analog scales (in which 0 indicates no symptoms; 10, severe symptoms). Overall satisfaction with the outcome of the procedure was also determined using a 0-to-10 visual analog scale (0 indicates totally dissatisfied; 10, totally satisfied). The presence or absence of abdominal bloating and the abilities to belch, to relieve abdominal distention by belching, and to eat a normal diet were determined with yes/no questions. Patients’ opinions of whether they thought they had made the correct decision to undergo surgery were also sought.

Details about adverse outcomes, including postoperative complications, hospital readmissions, and surgical revision, were also recorded. Postoperative esophageal manometry, 24-hour ambulatory pH monitoring, and endoscopy were generally performed only in symptomatic patients. For this reason, these data were not formally analyzed in this report. They were, however, taken into consideration when determining whether patients had developed recurrent reflux during follow-up.

Outcome data were analyzed to determine the long-term clinical efficacy of the anterior 180° partial fundoplication procedure, as well as the incidence of adverse outcomes and overall satisfaction with the surgical outcome.

RESULTS

From August 1, 1993, to November 30, 1999, 117 laparoscopic anterior 180° partial fundoplication procedures were performed by us or under our supervision. These patients constituted the study group. During the same period, we performed a laparoscopic Nissen fundoplication in an additional 487 patients.$^9$ Of the 117 study group patients, 109 procedures (93%) were completed laparoscopically and 8 (7%) were converted to an open operation. The reasons for conversion were the inability to reduce a large hiatal hernia, dense upper abdominal adhesions, an enlarged fatty liver, and esophageal perforation during esophageal dissection (in 2 patients each). The long-term outcome (minimum, 5 years’ follow-up) was determined for 113 patients (97%), and follow-up for these patients ranged between 5 and 11 years (mean, 6.4 years). Follow-up data were not available for 4 patients who could not be located at the time of the present study. Since undergoing the anterior fundoplication, 12 (11%) of the 113 patients died during follow-up. None of the deaths were linked to the laparoscopic procedure. The causes of death were disseminated carcinoma (5 patients [3 colonic, 2 lung]), myocardial infarction (1 patient), cerebrovascular accident (1 patient), bicycle accident (1 patient), suicide (1 patient), “old age” (2 patients), and complications of an open esophageal mucosectomy procedure for severe dysplasia in Barrett esophagus (1 patient).

One additional patient underwent an esophagectomy for an early-stage (T1) esophageal cancer in Barrett esophagus, which developed 4 years after the anterior partial fundoplication procedure. That patient’s original anterior partial fundoplication failed and he underwent an open Nissen fundoplication 1 year later. As of this writing (9 years after the original anterior partial fundoplication and 5 years after the esophagectomy), he is alive and well.
Further surgical procedures were undertaken in 12 patients (11%). Two of these were performed immediately using a laparoscopic approach: one at day 3 for an acute para-esophageal hiatal hernia, and the other at day 7 for acute dysphagia. In the latter patient, the esophageal hiatus was widened by removing 1 hiatal repair suture. Eight procedures (7%) were performed for recurrent reflux between 8 months and 6 years (median, 4 years) after the original fundoplication. All procedures entailed conversion to a Nissen fundoplication: 6 were completed using a laparoscopic technique and 2, by an open technique. Two more open-technique reoperations were undertaken for repair of a para-esophageal hiatal hernia at 2 and 3 years after the original anterior partial fundoplication. In addition, early postoperative dysphagia sufficient to require endoscopic dilatation occurred in 2 other patients. One of these patients was successfully treated with a single dilatation procedure, and the other underwent several dilatations before adequate swallowing was achieved.

Clinical outcome data at 5 to 11 years after surgery (late follow-up) were available for 100 patients. This group of patients excludes the 12 patients who died, the patient who underwent esophagectomy, and the 4 patients who were unavailable for follow-up. Gastroesophageal reflux symptoms were well controlled in most patients at late follow-up. When they reported heartburn using the analog scale, 46 patients had a postoperative score of 0 (no heartburn); 34 had a score of 1, 2, or 3 (occasional minor episodes of heartburn); 11 reported a score of 4 to 6 (moderate heartburn symptoms); and 9 gave a score of 7 or higher (significant troublesome heartburn). Most patients reported a moderate-to-severe heartburn score before surgery. Figure 1 compares the symptom of heartburn before surgery and at late follow-up. Twenty-two patients were taking acid-suppressing medications (proton pump inhibitors [12 patients], histamine, receptor antagonists [10 patients]) for “reflux” symptoms at late follow-up. All of these patients reported symptoms of heartburn. At late postoperative follow-up, patients were less likely to describe dysphagia to liquids and solids compared with preoperative scores (Figure 2 and Figure 3). Overall, fewer patients reported dysphagia after surgery than had before surgery. The overall data demonstrated a reduction in dysphagia after surgery.

At late follow-up, 91 patients were able to belch normally. Occasional epigastric bloating after eating was reported by 52 patients, and 37 of this subgroup (71%) were able to relieve this by belching. Some food types were avoided by 14 patients because of either food intolerance or dysphagia. The mean overall satisfaction score was 8.4 (median score, 9). Forty-five reported a satisfaction score of 10; 35, a score of 7 to 9; 17, a score of 4 to 6; and 3, a score of 3 or less. Ninety-five patients reported that they believed their original decision to undergo surgery was correct.

**COMMENT**

Since Nissen’s original description, the 360° total fundoplication has been the most common surgical procedure used for the treatment of gastroesophageal reflux. Although initially performed using an open abdominal...
or thoracic surgical approach, most Nissen fundoplications are now performed laparoscopically. Previous reports of long-term outcome following open Nissen fundoplication have confirmed a success rate of approximately 90% at 5 to 10 years after surgery. More recently, longer outcomes following laparoscopic Nissen fundoplication have also been reported. Our group previously described the 5- to 8-year follow-up outcomes for 176 patients who had undergone a laparoscopic Nissen fundoplication. In that series, clinical outcome data were obtained for 99% of patients. Reflux was well controlled in 87% of patients, and 90% considered the overall outcome to be good or excellent. Similar outcomes have been reported by others, although follow-up has been less complete in those reports.

It is now widely accepted that the Nissen fundoplication achieves an effective barrier to reflux in most patients at medium to long-term follow-up. Unfortunately, however, the new antireflux barrier is more effective than the lower esophageal sphincter in normal patients, which means that some patients will be troubled by adverse effects following surgery, such as persistent dysphagia, flatulence, gas bloat, and the inability to belch. In some of these patients, the adverse effects are sufficiently troublesome to interfere with quality of life, which can result in a poor overall outcome despite the fundoplication having provided effective control of the reflux symptoms.

For this reason, anterior and posterior partial fundoplication variants have been developed with the aim of reducing the incidence of adverse effects while still achieving effective control of gastroesophageal reflux symptoms. Previous randomized trials comparing a posterior partial fundoplication with a Nissen fundoplication have demonstrated a reduced incidence of gas-related adverse effects such as flatulence and abdominal bloating. However, whether patients who underwent a posterior partial fundoplication experience less dysphagia is less clear from these reports. Only 1 trial showed a reduced incidence of dysphagia, and this was at 4 months’ follow-up, with longer follow-up yet to be reported.

Ten years ago, we recognized the potential for an anterior fundoplication to achieve effective reflux control but with fewer adverse effects than either Nissen fundoplication or posterior partial fundoplication. Our group previously described the technique of laparoscopic anterior 180° partial fundoplication and reported short-term outcomes in an uncontrolled case series. We also compared this procedure with a Nissen fundoplication in a prospective randomized trial. Early clinical outcomes have been promising, with anterior partial fundoplication associated with a significantly reduced incidence of both dysphagia and gas-related adverse effects compared with Nissen fundoplication. One valid criticism of those early studies, however, was that only short-term follow-up was reported, and longer-term outcomes were required to prove the effectiveness of anterior 180° partial fundoplication as an antireflux procedure.

Our group recently reported the 5-year outcomes from a randomized trial of anterior 180° partial fundoplication vs Nissen fundoplication. The results of that trial confirmed the efficacy of the anterior 180° partial fundoplication at 5 years and showed a reduced rate of adverse effects and a high rate of patient satisfaction with the partial fundoplication procedure. The present study was undertaken to determine the long-term outcome (minimum follow-up, 5 years) in a larger group of patients who underwent a laparoscopic anterior 180° partial fundoplication. Our results show that the anterior 180° partial fundoplication is an effective procedure. Reflux remained well controlled in approximately 80% of patients at late follow-up, with less than 10% reporting an analog heartburn score of 7 or greater. Twenty-two percent of patients were receiving antisecretory medication at late follow-up in our study, although this rate is similar to that reported in most other late follow-up studies after Nissen fundoplication.

Surprisingly, not all patients with recurrent reflux at late follow-up were unhappy with their outcome. Almost all of the patients who underwent surgery in the present series had poorly controlled, troublesome reflux symptoms before surgery, despite using proton pump inhibitors. The symptoms of some of the patients who developed recurrent reflux after surgery, however, were fully controlled by acid-suppression medication, whereas these medications had been ineffective before surgery. Hence, this subgroup of patients with recurrent reflux regarded themselves as having benefited from surgery. Many of these patients rated the overall clinical outcome highly, which probably explains why 95% of patients were highly satisfied with the outcome of the surgery, even though full control of reflux by the operation alone was achieved in only 80%. Overall, it is reasonable to conclude that anterior 180° partial fundoplication achieved a satisfactory rate of overall success at 5 to 11 years’ follow-up.

In general, the other clinical outcomes investigated in the present study improved after surgery. Dysphagia was less common and less severe at late follow-up compared with preoperative dysphagia, and most patients were able to belch effectively. Epigastric bloating was less common after surgery, and most patients could eat a normal diet. These findings confirm that anterior 180° partial fundoplication is associated with a low rate of adverse effects after surgery, supporting the contention that there is a trade-off between the risk of recurrent reflux and the risk of adverse effects associated with antireflux procedures. For many patients, such a trade-off is acceptable.

When evaluating the outcome of surgery for gastroesophageal reflux, it is important to consider the completeness of clinical follow-up. In the era of open antireflux surgery, most follow-up studies failed to determine the outcome for more than 20% of their patients. In general, case series of patients undergoing laparoscopic antireflux surgery have similar rates of follow-up. The exceptions are the 99% follow-up rate in our previously reported 5- to 8-year follow-up after laparoscopic Nissen fundoplication, and the 100% and 98% 5-year follow-up rates in 2 of our randomized trials. Analysis of data from one of those randomized trials demonstrated that clinical outcomes may appear to be better than they really are if complete or near-complete follow-up is not obtained. Patients who do not respond to initial follow-up attempts are more likely than patients who volunteer for follow-up studies to have a poor outcome. For
this reason, studies without high follow-up rates are at risk of underreporting adverse outcomes. A strength of the present study is that a late clinical outcome was determined for 97% of our patients with evaluable data.

However, the results reported herein should be interpreted with some caution. It is not appropriate to directly compare these results with outcomes for Nissen fundoplication reported elsewhere because some selection bias was involved with these patients that was not in the randomized trials. Nevertheless, the outcomes are at least consistent with the outcome at 5 years in the previously reported randomized controlled trial of anterior 180° partial fundoplication vs Nissen fundoplication. Therefore, the larger patient cohort and longer follow-up in the present study support the contention that laparoscopic anterior 180° partial fundoplication is an appropriate procedure for patients with gastroesophageal reflux.

Our study might also be criticized for not reporting objective outcome data. Patients were not systematically reevaluated with esophageal manometry, pH monitoring, or endoscopy at late follow-up, and we have therefore limited our report to clinical outcomes. Ultimately, however, the measure of success after a surgical procedure is determined by the patient’s view of the outcome rather than by the results of various investigations.

We conclude, therefore, that laparoscopic anterior 180° partial fundoplication is an appropriate procedure for patients undergoing surgery for gastroesophageal reflux. Patients offered this procedure should be informed that the risk is offset by a lower risk of adverse effects, and for this reason the overall satisfaction with the procedure at late follow-up is high.

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REFERENCES