

Laparoscopic Revision of Failed Fundoplication and Hiatal Herniorraphy

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Abstract

Objective: The aim of this study was to evaluate the mechanisms of failure after laparoscopic fundoplication and the results of revision laparoscopic fundoplication.

Background: Laparoscopic Nissen fundoplication has become the most commonly performed antireflux procedure for the treatment of gastroesophageal reflux disease, with success rates from 90 to 95%. Persistent or new symptoms often warrant endoscopic and radiographic studies to find the cause of surgical failure. In experienced hands, reoperative antireflux surgery can be done laparoscopically. We performed a retrospective analysis of all laparoscopic revision of failed fundoplications done by the principle author and the respective fellow within the laparoscopic fellowship from 1992 to 2006.

Methods: A review was performed on patients who underwent laparoscopic revision of a failed primary laparoscopic fundoplication.

Results: Laparoscopic revision of failed fundoplication was performed on 68 patients between 1992 and 2006. The success rate of the laparoscopic redo Nissen fundoplication was 86%. Symptoms prior to the revision procedure included heartburn (69%), dysphagia (8.8%), or both (11.7%). Preoperative evaluation revealed esophagitis in 41%, hiatal hernia with esophagitis in 36%, hiatal hernia without esophagitis in 7.3%, stenosis in 11.74%, and dysmotility in 2.4%. The main laparoscopic revisions included fundoplication alone (41%) or fundoplication with hiatal hernia repair (50%). Four gastric perforations occurred; these were repaired primarily without further incident. An open conversion was performed in 1 patient. Length of stay was 2.5 ± 1.0 days. Mean follow-up was 22 months (range, 6–42), during which failure of the redo procedure was noted in 9 patients (13.23%).

Conclusion: Laparoscopic redo antireflux surgery, performed in a laparoscopic fellowship program, produces excellent results that approach the success rates of primary operations.

Introduction

THE NUMBERS OF FUNDOPLICATIONS performed in the United States in 1993, 1998, and 2002 were 22,000, 40,000, and 41,000,¹ respectively, suggesting that there has been a leveling off in the number of these procedures performed after the initial surge that was associated with the advent of minimally invasive fundoplication in the early 1990s.² The reason for this stabilization is multifactorial, but it may be, in

part, due to a perception in the medical community of mediocre results after minimally invasive fundoplication.³ This perception has been perpetuated by one specific study of questionable design.⁴ However, the success rate of laparoscopic fundoplication in specialty centers is 90–95%.⁵

Due to the increase in primary fundoplications performed, there has been an increase in the number of failed procedures. The reoperative rate after primary laparoscopic fundoplication in specialty centers was 2.8% in a collection of

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TABLE 1. PREOPERATIVE SYMPTOMS BEFORE LAPAROSCOPIC REVISION OF FAILED FUNDOPPLICATION AND HIATAL HERNIORRAPHY

| Symptom | Number (%) |
|-------------------------------|------------|
| Heartburn | 47 (69%) |
| Dysphagia | 6 (8.8%) |
| Heartburn + dysphagia | 8 (11.7%) |
| Early satiety/epigastria pain | 5 (7.3%) |
| Emesis | 2 (2.9%) |

over 10,000 reported cases.⁵ Revisional fundoplication procedures occurred during the era of open antireflux surgery.⁶ There had been a previous assumption that failure after primary laparoscopic procedures should be treated with an open revision. During the latter 1990s, however, a number of reports of laparoscopic revision fundoplications demonstrated the feasibility of minimally invasive revision after the failure of both open and laparoscopic antireflux procedures.^{5,7-9} We reviewed our experience in the reconstruction of laparoscopic fundoplication with or without hiatal hernia repair following a failed primary operation. Our aim in this study was to describe the patterns of failure seen after primary laparoscopic fundoplication, to examine our own results after minimally invasive revision, and to make recommendations based on what we observed.

Materials and Methods

A retrospective analysis of all patients who underwent a laparoscopic reconstruction of fundoplication with or without herniorraphy, under a single attending surgeon (CTF) within an academic residency-fellowship program over a 14-year period (1992–2006), was performed. All patients considered for revisional surgery underwent a preoperative esophagogastroduodenoscopy (EGD) and upper gastrointestinal series (UGI). Manometry was performed selectively in patients with symptoms of dysphagia/odynophagia and/or with evidence of abnormal motility on UGI.¹⁰

Our technique for both primary and reoperative laparoscopic Nissen fundoplication with hiatal herniorraphy has been described.^{9,11,12} Briefly, the abdomen was entered with an optical trocar. Adhesions were invariably present between the undersurface of the left lobe of the liver and the gastric wall. These adhesions were taken down cautiously to avoid inadvertent injury to the stomach or excess bleeding from capsular liver tears. A lighted bougie was placed by the anesthesiologist to assist in the identification of the esophagus. Next, the right and left bundle of the right crus were dissected away from the esophago-gastric junction and fundoplication.

In the majority of cases, the fundoplication was then identified and the plication stitches were divided to restore the normal anatomic position of the fundus. The short gastric vessels were ligated by using the Harmonic Scalpel (Ethicon Endo-Surgery, Inc., Cincinnati, OH), if not already performed during the primary procedure. The esophagus was mobilized so that 3–4 cm lay intra-abdominally without tension. If necessary, a posterior cruroplasty then was performed with interrupted 2-0 polyester sutures. If the hiatal defect was greater than 8 (1992–2000) or 5 cm (2000–2006),

then a polytetrafluoroethylene (DualMesh; W.L. Gore and Associates, Flagstaff, AZ) onlay mesh patch was placed, as described before.^{11,13} The procedure was completed with a loose three-stitch, 2–3 cm, 360-degree wrap; the most cephalad stitch incorporated the anterior arch of the right crus. The esophagus was not incorporated into the anchoring sutures. All patients had an esophagogram with water-soluble contrast (gastrograffin) on the first postoperative day.

A soft diet (with avoidance of gas-producing food and carbonation) was begun on postoperative day 1; the patient was discharged when he or she had an adequate oral intake. Follow-up consisted of clinic appointments at 1 week, 1, 3, 6 months, and yearly thereafter. Diagnostic studies, such as EGD or UGI, were ordered during follow-up if a patient developed symptoms.

Results

Revision laparoscopic fundoplication was undertaken in 68 patients; 7 of these had their primary procedure performed by the senior author.^{10,14} The mean age was 42 (range, 23–78). The primary procedure either was a laparoscopic Nissen ($n = 61$) or laparoscopic Toupet ($n = 7$) fundoplication. The presenting symptoms and results of diagnostic evaluation are given in Tables 1 and 2, respectively. Two manometries were performed in patients whose dysphagia could not be explained by findings of the EGD and/or UGI.

The duration of surgery was 2.6 ± 0.4 hours (range, 0.7–4.5). Conversion to open occurred in (1.4%) 1 patient secondary to dense adhesions. The intraoperative findings with respect to each patient are displayed in Table 3. Hiatal hernia, whether alone or in combination with another finding, was present in (51%) 35 patients; similar totals for fundoplication slippage and malpositioned fundoplication were 8 (11.7%) and 11 patients (16%), respectively. Malpositioning findings included a fundus sutured to the greater or lesser curvature or the corpus of the stomach. Twenty-one of the hiatal hernias had a defect of ≥ 5 cm; 19 of these were repaired with a polytetrafluoroethylene (PTFE) reinforcement of the hiatal herniorraphy. Mesh was not used on the other 2 large-defect hernias because of intraoperative gastric perforation. No esophageal lengthening procedures (i.e., Collis gastroplasty) were performed, since adequate intra-abdominal mobilization of the esophagus was achieved in all patients, which mimics our experience in primary fundoplication cases.¹⁵

The revisional procedures performed are listed in Table 4. The vast majority of patients (63; 92.6%) required complete deconstruction and reconstruction of the fundoplication; however, removal or addition of sutures to the existing fun-

TABLE 2. RESULTS OF PREOPERATIVE EVALUATION (ENDOSCOPY, ESOPHAGOGRAM, MANOMETRY)

| Finding | Number (%) |
|-------------------------------|------------|
| Esophagitis | 28 (41%) |
| Hiatal hernia and esophagitis | 25 (36%) |
| Hiatal hernia | 5 (7.3%) |
| Stenosis | 8 (11.7%) |
| Dysmotility | 2 (2.4%) |

TABLE 3. INTRAOPERATIVE FINDINGS DURING LAPAROSCOPIC REVISION OF FAILED FUNDOPLICATION AND HIATAL HERNIORRAPHY

| Finding | Number (%) |
|------------------------------------------------|------------|
| Slipped fundoplication and hiatal hernia | 23 (33.8%) |
| Slipped fundoplication alone | 8 (11.7%) |
| Malpositioned fundoplication alone | 11 (16%) |
| Malpositioned fundoplication and hiatal hernia | 5 (7.3%) |
| Tight fundoplication | 5 (7.3%) |
| Hiatal hernia alone | 7 (10.2%) |
| Loose fundoplication | 6 (8.8%) |
| Tight cruroplasty | 3 (4.4%) |

doplication or cruroplasty was sufficient in 5 patients. Intraoperative complications consisted of 4 patients with gastric perforation. These perforations were sutured laparoscopically and did not require conversion. There was no adverse outcome from these perforations. There was no esophageal perforation. The length of stay was 2.5 ± 1.0 days (range, 1–6). Perioperative mortality was zero.

Median follow-up was 27 months (range, 6–42). Procedure failure was noted in 9 patients (13.2%); the hiatal hernia recurred in 6 patients, while fundoplication failure occurred in 3. All fundoplication and hiatal herniorraphy failures occurred within the first 6 months. The control of symptoms in the other 59 patients has been good to excellent (Visick I–II). Two of the patients with recurrent hiatal hernia did not have a mesh repair during the redo procedure because of an intraoperative gastric perforation. The other recurrent hiatal hernias were in 3 patients that had a repair with a simple cruroplasty and in 1 patient who had a mesh reinforcement. The reoccurrence in the patient with the mesh reinforcement was through the keyhole of the mesh that, apparently, was constructed too largely. None of the patients in this series has undergone a third antireflux procedure.

Discussion

We had previously published a preliminary report on nine reconstructions of failed antireflux procedures.⁹ The most common etiology of failure in our prior report was malpositioning of the fundoplication to the body of the stomach. In the present report, the incidence of a malpositioned fundoplication was 16%, which was lower than the initial report (56%). Hiatal hernia recurrence was the single most common finding in the present report (51%). In fact, recurrent hiatal hernia is currently recognized as the most common cause of failure after an antireflux procedure with an incidence of ap-

proximately 50%.^{5,16–23} Others have noted issues with the hiatal disruption during laparoscopic revision fundoplication.^{8,16,18,19,22,24–34} Herniation of the wrap, whether due to short esophagus or inadequate repair of the hiatus, is a primary mechanism of failure after minimally invasive fundoplication. We feel that this is almost always secondary to an inadequate repair of the esophageal hiatus or insufficient esophageal mobilization, as opposed to a shortened esophagus.

Laparoscopic revision appears to be associated with less complication, compared to the open-approach era.³⁵ Gastric perforation was the most common intraoperative complication. This complication can be minimized with the use of atraumatic graspers.^{16,24}

We and others advocate the use of mesh reinforcement of hiatal hernia repair in order to decrease the hernia recurrence.^{13,17,36–38} The efficacy of PTFE reinforcement in hiatal herniorraphy has been demonstrated in a randomized trial.¹³ Our current indication for mesh utilization is a hiatal defect greater than 5 cm. In addition, weak crural tissue should be another indication for the use of mesh, especially in reoperations for failed hiatal hernia. We hypothesize that being more liberal in the utilization of mesh with our reconstruction of hiatal herniorraphies would have decreased the rate of recurrences. There has been concern that placement of prosthesis at the esophageal hiatus will invite an erosive complication. We have not observed any such complication in our patients with mesh at the hiatus, and we are aware of only one case report when PTFE is used.⁴⁰ We, therefore, feel that any theoretic risk of luminal erosion after the placement of a PTFE mesh at the hiatus is offset by the marked reduction in hiatal herniation.

After hiatal hernia recurrence, the next most common finding associated with failure was wrap slippage. We perform routine fixation of the fundoplication to the anterior arch of the right crus, but we avoid incorporating the esophagus into the wrap. We feel that such incorporation might increase the chance for subsequent dysphagia. While this is difficult to prove with our current data, we have not seen a significant long-term postoperative dysphagia with this technique, compared to others, after primary fundoplication.^{40–43} Wrap malpositioning was another common finding. We and others believe that this result can be avoided by the complete division of the short gastric vessels and the unequivocal identification of the angle of His.^{28,44} These maneuvers will help the surgeon to perform a fundus-to-fundus wrap, as opposed to a fundus-to-body wrap.

It is of the utmost importance that an extensive evaluation should be done to identify the cause of failure preoperatively. We found, through the course of treating patients with failed fundoplications and hiatal hernias, that a very impor-

TABLE 4. PROCEDURES PERFORMED DURING REOPERATION

| Procedure | Number (%) |
|-----------------------------------------------------------------|------------|
| Revision fundoplication | 28 (41%) |
| Revision fundoplication and mesh-reinforced hiatal herniorraphy | 19 (27%) |
| Revision fundoplication and hiatal herniorraphy | 16 (23%) |
| Additional sutures on loose fundoplication | 2 (2.9%) |
| Removal of sutures from cruroplasty | 3 (4.4%) |

tant component of preoperative evaluation of these patients is an experienced upper gastrointestinal radiologist. Fluoroscopic evaluation of these patients, when placed in different positions on the radiology table, and when pressure is exerted on the abdomen, can help diagnose the cause of failure. At times, however, the diagnosis of the cause of failure is made intraoperatively.

A somewhat controversial issue is the intraoperative use of a bougie, that has been argued, by others, to potentially cause esophageal perforation. We find the use of the lighted bougie very helpful in identifying the position of the esophagus, once the left lobe of the liver has been mobilized. The introduction of this lighted bougie should be done very carefully by an experienced anesthesiologist or a senior member of the surgical team.

The intermediate success rate of our revisional fundoplication procedures was 86%, which is lower than the reported 90–95% success rate of primary procedures.⁵ The 4% disparity between the primary funduplications and revisions may be explained by the fact that the latter are more demanding technically, in addition to the fact that tissue integrity may have been compromised with the first procedure. One may claim that a more liberal use of mesh reinforcement of cruroplasty during reoperations may reduce the recurrence rate, but this is only speculative.

Conclusion

Our success rate in the revision procedure is comparable with that reported from other groups, many of which have found lower success in revision procedures.^{5,16–19,20–22,26,27,30,31,45–49} The aggregate of published evidence suggests that revision laparoscopic fundoplication and hiatal herniorrhaphy is effective, but technically challenging; thus, these revisional procedures should probably be performed in specialty centers. More important, however, are lessons learned in minimizing failure after primary operation. These would include 1) careful construction of the wrap, 2) complete mobilization of fundus by division of the short gastric vessels, 3) visualization of the angle of His, 4) adequate esophageal mobilization, 5) posterior cruroplasty, and 6) consideration for mesh reinforcement of the cruroplasty in the face of a large hiatal defect.

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No competing financial interests exist.

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