Durability of Laparoscopic Repair of Paraesophageal Hernia

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Objectives
To define a method of primary repair that would minimize hernia recurrence and to report medium-term follow-up of patients who underwent laparoscopic repair of paraesophageal hernia to verify durability of the repair and to assess the effect of inclusion of an antireflux procedure.

Summary Background Data
Primary paraesophageal hernia repair was completed laparoscopically in 55 patients. There were five recurrences within 6 months when the sac was not excised (20%). After institution of a technique of total sac excision in 30 subsequent repairs, no early recurrences were observed.

Methods
Inclusion of an antireflux procedure, incidence of subsequent hernia recurrence, dysphagia, and gastroesophageal reflux symptoms were recorded in clinical follow-up of patients who underwent a laparoscopic procedure.

Results
Mean length of follow-up was 29 months. Forty-nine patients were available for follow-up, and one patient had died of lung cancer. Mean age at surgery was 68 years. The surgical morbidity rate in elderly patients was no greater than in younger patients. Eleven patients (22%) had symptoms of mild to moderate reflux, and 15 were taking acid-reduction medication for a variety of dyspeptic complaints. All but 2 of these 15 had undergone 360° fundoplication at initial repair. Two patients (4%) had late recurrent hernia, each small, demonstrated by esophagram or endoscopy.

Conclusions
Laparoscopic repair in the medium term appeared durable. The incidence of postsurgical reflux symptoms was unrelated to inclusion of an antireflux procedure. In the absence of motility data, partial fundoplication was preferred, although dysphagia after floppy 360° wrap was rare. With the low morbidity rate of this procedure, correction of symptomatic paraesophageal hernia appears indicated in patients regardless of age.

With laparoscopic repair of paraesophageal hernia (LRPH) becoming more common,1-5 it is important to know whether the short-term benefits of reduced pain, hospitalization, and convalescence translate into longer-term results equivalent to the technique it supersedes. Any study that does not follow its patients to death, as has been recommended,6 will not represent the durability of the repair. Hernia recurrence after conventional primary repair may be as low as 8% at 4 years of follow-up7 or as high as 50% if measured radiographically.8 Several issues are germane to any account of repair. Is manometry or 24-hour pH testing of value in presurgical evaluation? Should an antireflux procedure be used routinely or selectively? A newcomer to the debate is the concept of prosthetic repair of the diaphragmatic defect. Little has been discussed concerning the role of sac excision. Our experience and conclusions with regard to each of these issues are presented.

METHODS
A group of patients who underwent LRPH (and were also the subject of a previous report9) is being followed longitudinally to determine the durability of the repair. Two primary surgeons performed surgery, supervised fellows, or assisted colleagues during LRPH performed at our institution. Diagnostic studies included endoscopy and barium esophagram in all cases. Twenty-four-hour pH studies were
performed if the chief presenting symptom was gastroesophageal reflux (GER). Hernias were classified as type II if there was no significant sliding component and type III if cephalad displacement of the esophagogastric (EG) junction was confirmed at surgery. Type IV was a type III hernia containing another intrathoracic structure such as spleen or colon.

(Many physicians, including gastroenterologists, still confuse the clinical significance of type I and type II/III hernias. In essence, type I hernias are common, benign abnormalities that do not require repair unless they are associated with severe GER. Type II and III hernias are characterized by chronic hemorrhage or mechanical symptomenology such as volvulus or obstruction and should be repaired once diagnosed, especially if symptomatic.)

Surgical Technique

Modified lithotomy position, five-port laparoscopic access to the hialtal region using a 45° telescope, and suture approximation of the crura remained unchanged throughout the series. The crura were approximated anterior or posterior to the esophagus using horizontal mattress sutures buttressed with Teflon felt pledgeds until the esophagus was just snug in the hiatus when checked with a 56F bougie. Mobilization and excision of the hernia sac, a fundamental step in the modified technique, was performed as previously described (Fig. 1). Short floppy Nissen (360°) or Toupet (270°) fundoplication, limited gastropexy by suture of fundus to diaphragm, or no fixation completed the procedure. Laparoscopic coagulating shears (Harmonic Scalpel, Ethicon, Somerville, NJ) also replaced scissors and clips for division and ligation of tissues midway through the series, but it is unlikely that this had any influence on the results of repair. Patients who underwent conversion to laparotomy/thoracotomy were not included in follow-up.

Postoperative nasogastric drainage was not used in any case. Oral opiate compound analgesics such as acetaminophen and oxycodone or codeine, started the first evening after surgery, were invariably adequate; they were replaced with narcotic-free formulations after 24 to 36 hours. Barium esophagography was performed routinely on the first morning after surgery to document the position of the stomach. Radiopaque clips secured to the cut edge of the sac or wrap were useful “poor man’s markers” of the site of the gastric fundus on scout films of the upper abdomen. A normal diet was permitted from day 1, but patients were advised to avoid foods that could not easily be chewed into a small manageable bolus, such as steak or bagels.

Data were collected by direct telephone interviews by a resident who had not participated in the surgical procedure, during office visits, or from referring physicians and were added to a prospectively maintained LRPH patient data base in which the following categories of information were collated:

- Complaints of chest pain, heartburn, regurgitation, dysphagia, odynophagia
- Results of subsequent barium esophagram or endoscopy
- Need for acid-reduction therapy, including proton pump inhibitors, beta-H₂ antagonists, or antacids.

Because sac excision was introduced toward the middle of the series, mean follow-up of these patients is naturally shorter (20 months) than those from the group in which the sac was not excised (40 months). At the time of writing, six patients had been lost to follow-up (four in the first group and two in the second). They have been excluded from further analysis. Two had undergone surgery overseas, and no reliable data were available as to their state of health. One patient had died of lung
Table 1. CORRELATION OF PREOPERATIVE AND POSTOPERATIVE SYMPTOMS OF GER

<table>
<thead>
<tr>
<th>Anti Reflux Procedure</th>
<th>Hernia Type</th>
<th>Number Operated</th>
<th>Preop GER Symptoms</th>
<th>Postop GER Symptoms</th>
<th>Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nissen (30)</td>
<td>II</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>(12)</td>
<td>III</td>
<td>20</td>
<td>9</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Toupet (7)</td>
<td>III</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1*</td>
</tr>
<tr>
<td>None/pexy† (12)</td>
<td>II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(4)</td>
<td>III</td>
<td>8</td>
<td>1†</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>1</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* Early recurrence, never reoperated, unsatisfactory result.
† Nine had esophageal dysmotility. Three were operated emergently.
‡ Known benign esophageal stricture dilated intraoperatively.

cancer. The youngest patient in the series, who had undergone repair of a rare parahiatal hernia, was included in this report because of the physiologic resemblance of this to a type II paraesophageal hernia.

Under the control of their primary care physician, and in consultation with the surgeon, patients underwent follow-up endoscopy or barium esophagography as dictated by the presence of symptoms, not on a routine basis. Ideal follow-up of these patients would be indefinite, punctuated by programmed performance of barium esophagography in addition to periodic endoscopy. The realities of practice in an aging but mobile patient population, as represented by this group, meant that such an ideal was impossible to realize. Postsurgical manometry and 24-hour pH studies were not performed, nor were they thought to be indicated in any patient. We are aware of the shortcomings of a study that does not include objective follow-up for all patients, and this deficiency is being addressed during longitudinal follow-up of these and subsequent patients.

RESULTS

Fifty-five patients, the first 25 of whom had not undergone sac excision and 30 subsequent patients who had, were recorded in our prospective data base. Data from a total of 49 patients available for follow-up are summarized in Table 1. All but one had undergone primary repair of the hernia defect consisting of reduction of the hernia and anterior or posterior suture closure of the hiatus with or without an antireflux procedure. One had mesh repair of a large defect with 360° wrap; the hernia recurred almost immediately, and the patient underwent open repair. Thirty-eight patients had type III or IV hernia (76%), and 22 (44%) underwent 360° fundoplication regardless of the presence of symptoms of GER before surgery (16%).

Thirty-seven patients underwent an antireflux procedure (a 360° [Nissen] fundoplication in 30, partial [Toupet] fundoplication in 7), of whom 9 (18% of the total group) had preexisting evidence of GER. Seven of these nine had persistent (although usually mild) GER symptoms at follow-up, and eight were taking acid reduction therapy. Toupet fundoplication or no wrap was reserved for patients with known dysmotility or in whom manometry could not be performed due to the urgency of presentation. Two patients in this group had GER symptoms (after Toupet), and four were taking acid reduction therapy.

Of five patients whose hernia recurred in the 2 months after surgery, three underwent immediate open revision. In one who was treated expectantly, recurrent gastric volvulus developed 45 months later, requiring thoracoabdominal repair with proximal gastric resection; after prolonged convalescence, this patient is alive and well. The other has never undergone another procedure. In two of these cases for which the findings were obvious, the cause of reherniation was failure to recognize and correct the presence of a large posterior sac. This allowed posterior repulsion, similar to the anterior hinge described by Skinner and Belsey⁶ formed by the intact anterior repair.

Two patients (4%) were found to have small type I recurrences at delayed follow-up with barium esophagography and endoscopy. These patients had mild reflux symptoms; only one needed medication. Most recurrences occurred within a year of repair, as was the experience of others.⁷ For patients who did not undergo sac excision, no clinically significant recurrent hernia was identified, so that for the purposes of follow-up, the two groups can now be considered equivalent.

Two patients (4%) had persistent dysphagia after surgery. Each had normal presurgical motility and had undergone a 360° wrap. One has required several esophageal dilations (which we have found to be disappointing when performed for dysphagia after antireflux surgery) and is still moderately symptomatic. The other had repair of a parahiatal hernia and, because of her young age (34 years) and the degree of mobilization, had a 360° wrap. Her dysphagia occurs weekly and appears to be partly functional, because there is no evidence of holdup or hernia recurrence on a
recent esophagram. Thus, dysphagia after inclusion of an antireflux procedure was uncommon.

Thirty-two patients have undergone surgery subsequent to those reported above. Two early recurrences were detected by routine post-surgical esophagography on the first day after surgery. On each occasion, stitches were found to have cut through the crural muscle, reopening the hiatus. In one of these cases, violent vomiting after surgery, an unusual symptom in these patients, was the likely cause. In the other, attenuated crura were ill approximated with stitches. The patient underwent a second procedure early using laparoscopy, and exposure of the hiatal region was not difficult. A mesh prosthesis was used to repair the defect in each instance, and the patients recovered without further incident.

In one woman age 82, delayed gastric emptying immediately developed despite care to avoid trauma to the vagus nerves. Although relieved of her presurgical obstructive symptoms, she now lives on a semisolid diet.

**DISCUSSION**

To those experienced with laparoscopic antireflux surgery, the technical challenge of LRPH is significantly greater. The goal of the procedure is to correct a life-threatening,6,11 anatomic defect with a technique that is as durable and free of complications as possible. Early attempts by us and other authors failed to address the issue of sac excision, which is a constant element of conventional repair, albeit sketchily described in the classic accounts of the procedure. It was thought that this would complicate the procedure and would be difficult or impossible to perform. With increasing experience, we realized that not only was sac excision straightforward, but it also simplified considerably the anatomic basis of the surgical approach. The phrenoesophageal membrane, composed of endoabdominal and endothoracic fascia, inserts into the esophagus just above the EG junction,12,13 irrespective of how much displacement of the fundus and esophagus has occurred during development of the hernia. Starting at the crus on each side, by seizing this layer with its overlying peritoneum and peeling both out of the mediastinum, the esophagus can be safely located. Huntington14 has described the two sac elements of a type III hernia, which includes an anterior or greater and a posterior or lesser sac in continuity with the lesser sac of the peritoneal cavity. Total mobilization of both elements of the sac, when present, from the mediastinum ensures that the esophagus is no longer tethered above the hiatus and the EG junction is allowed to return to its normal position. From a practical standpoint during laparoscopy, it is difficult to reduce prolapsed stomach against the resistance of positive-pressure pneumoperitoneum without equalizing pressure on each side of the sac. The easy solution is to remove the sac first.

Destruction of the attachments of the esophagus to the preaortic fascia is considered a mistake by some authors,10,15 but failure to correct the posterior element of the hernia was responsible for at least two of the five early recurrences in the group that did not undergo sac excision. We consider that circumferential mobilization of the gut tube proximal and distal to the EG junction in type III hernia is the only way to ensure elimination of the posterior sac element. Because most paraesophageal hernias are type III, preservation of the posterior attachments said to contribute to the antireflux mechanism is possible in only a minority of cases.

Removal of the sac also reduces the possibility of developing a symptomatic collection in a residual serous cavity, as was our experience on one occasion. The need for thoracotomy to excise residual sac has been reported.16

The addition of an antireflux procedure to the repair is still debated by many authorities (Table 2). Of the 49 patients available for follow-up, 10 (20%) had presurgical symptoms of GER. All but one of these had undergone Nissen type 360° wrap after crural repair, and five had continuing symptoms of reflux. Two patients who had a Toupet 270° wrap complained of mild symptoms of reflux. Thus, all 11 patients with symptoms suggestive of postsurgical GER had undergone an antireflux procedure. No patients who had a limited gastropexy, or no wrap at all,
complained of reflux symptoms, and only one of these patients had presurgical GER. Encouraged by good fixation of the fundus and EG junction to the crura with the Toupet fundoplication, and buoyed by the experience of others,\(^2\) this technique was used with increasing frequency toward the end of our series in patients who had not undergone manometry or who had known dysmotility.

Lack of correlation between symptoms of GER and objective studies is well recognized. Endoscopy is the gold standard for identification of esophagitis or neoplasm. If only one investigation apart from endoscopy were permitted for the presurgical workup, video esophagography would be the test of choice. Real-time screening provides information regarding esophageal motility in addition to the anatomic features of the hernia.

We cannot give a definitive answer as to the need for an antireflux procedure with repair of the hernia from these data without objective documentation of the presence or absence of GER. Although it is of interest to have documented motility, lower esophageal sphincter pressure, and esophageal acid exposure by 24-hour pH studies, in the absence of symptoms of GER and significant esophagitis, the likelihood of developing postsurgical reflux is small whether a wrap is performed or not. Should clinically significant reflux develop afterward, it can usually be managed with medication. Knowing that well-constructed floppy wraps are associated with minimal problems, surgeons who wish to limit the possibility of disabling postsurgical reflux should use them commonly, especially in younger patients. If dysphagia must be avoided at all costs, then simply attaching the fundus to the diaphragm, which recreates the angle of His, may be sufficient. In patients with known GER and dysmotility, partial fundoplication is a safe compromise, offering good gastric fixation and reasonable antireflux effect.

Because of the possibility of wrap migration, it has been our practice, as it is of others,\(^17\) to perform a limited barium esophagram on the first morning after surgery in all patients undergoing antireflux procedures or repair of paraesophageal hernia to confirm the position of the fundus and esophageal and gastric emptying before discharge. Nonetheless, all but 1 of 5 early recurrences in our first 55 cases were documented after this study. Four of the five early recurrences followed 360° wrap, suggesting that without fixation of the wrap to the diaphragm, there is no intrinsic protection against repulsion provided by the wrap, as has been suggested.\(^18\)

The incidence of chronic severe GER was low in this series when compared with others,\(^19\) and the incidence of clinically significant esophageal shortening is remarkably small. We have not encountered any paraesophageal hernia in the last 50 consecutive cases that, when treated with sac excision, would not reduce without tension. This supports the notion that the process responsible for the development of the hernia does not include true shortening of the esophagus.\(^20\) As yet, no esophageal lengthening procedure, such as a Collis–Nissen gastroplasty, has been necessary in any of these patients.

The incidence of complications or hospitalization was not greater in the elderly (equal to or older than the mean age of patients in this series), although the sample is small. This supports an aggressive approach to surgical correction of paraesophageal hernia, regardless of age.

The fear of recurrence after repair of paraesophageal hernia has led some authors to recommend inclusion of a gastrostomy\(^7\) or gastropexy\(^21–23\) to prevent repulsion of the stomach into the mediastinum. More recently, others have advocated "tension-free"\(^5,24–26\) prosthetic repair of the hialtal defect in conjunction with laparoscopic techniques. This move away from primary repair appears stimulated by the success of "tension-free" approaches to both open and laparoscopic repair of inguinal hernia. With no hollow structure other than vas and blood vessels passing through or near the repair, a prosthesis can be used with impunity, as is illustrated by the remarkably few complications after prosthetic repair of inguinal hernia. This is not the case at the hiatus, where, when repaired, a nongeosized hollow viscus (esophagus) is in direct contact with and at right angles to the edge of a fixed foreign object (prosthesis). Small\(^5,24,26\) and larger\(^25\) series using prosthetic repair have not reported any instances of prosthesis-related complications, but longer follow-up of these groups is essential. We think that for most cases, it is better to perform a repair that uses native tissue. The apparent size of the hernia defect is exaggerated by pneumoperitoneum, but there is an abundance of diaphragm available for closure, in contrast to inguinal hernia, in which the edges of the muscular defect are more fixed. The edges of the hiatus can usually be drawn together with carefully inserted Teflon pledged horizontal mattress sutures aligned to encircle the fiber bundles of each crux, which pick up fascia and peritoneum and are not overtightened. Surprisingly large defects come together easily. If correctly performed, primary anatomic repair yields satisfactory results. Thus, it seems logical to use it routinely for all but the most attenuated hernia defects that will not hold a stitch.

With continued follow-up of patients undergoing LRPH, longer-term evaluation will add more information to what is known of the effectiveness of this promising new procedure.

CONCLUSIONS

Our thesis is that in most cases, anatomic removal of the paraesophageal hernia sac allows complete descent of the EG junction without tension, which helps to prevent failure of primary tissue suture repair of the hialtal defect. This approach during laparoscopic repair has the merits of technical simplicity and accuracy, and avoids potential complications such as gastrostomy leak or prosthetic erosion. Prosthetic repair should be reserved for diaphragmatic tissue insufficiently robust to take stitches without cutting through. The incidence of true esophageal shortening is low, so esophageal lengthening procedures should rarely if ever be necessary. The morbidity rate after LRPH is low, suggesting
that expectant management of symptomatic hernia is inappropriate regardless of the patient’s age. The durability of laparoscopic repair in experienced hands appears equivalent to that of conventional surgery.

References


Discussion

DR. TOM R. DEMEESTER (LOS ANGELES, CALIFORNIA): Dr. Edye, I admire your courage to investigate an area that is controversial or as you described it, can be sort of a snake bite. I gather, as I listen to your presentation and read your manuscript that the change from a Nissen to a Toupet antireflux procedure reflects that you are quite unsure what is the appropriate procedure to use in this situation.

I have a comment and some concerns regarding some aspects of the manuscript that weren’t brought out in the presentation. My comment is that I am sympathetic with your approach to the dissection of the paraesophageal hernia. You emphasized this in the manuscript as well, and I think your description of the laparoscopic dissection of a paraesophageal hernia is a contribution.

My concerns are as follows: First, it is important to realize that with paraesophageal hernias we are not only correcting reflux, if it exists, but mainly repairing the hernia, to remove the potential insults they can cause, such as bleeding, strangulation and perforation.

You mention in the manuscript that taking out the sack prevents recurrence. Are you sure this is a correct conclusion? Is it possible that in your early experience, when you didn’t take out the sack, the closure of the crura was inadequate and gave rise to a high recurrence rate? You now removed the sack and have concluded that it was the cause of the recurrences. It may be that with the sack removed you could close the crura better. Second, I am concerned that you may not have properly assessed your patients for the presence of recurrences. If one accepts the need for acid suppression therapy as an indication of a breakdown, then 30% of the patients who had a Toupet repair, and an 18% for those with no antireflux repair are failures. I would suspect that these patients require medication because reflux has occurred due to the absence of or a breakdown of the repair. The simplest way of evaluating a repair is with a barium swallow, a test not done in your study. So I question the bases for your conclusions. Third, I would take exception to the statement that it may not be necessary to study these patients before surgery. We have seen a number of patients who do have reflux symptoms, especially with a type III hernia. A review of the 25 type III hernias that you reported, about 50% of them had postoperative reflux symptoms. Perhaps it would have been wise to have studied these patients before surgery. Fourth, I would like to finish by emphasizing a point you made in the paper, that is you had some doubt about the existence of short esophagus. I think the two problems with type III hernia are the large hiatal opening, as you demonstrated so nicely, and the possibility of a short esophagus. The large hiatal opening has a predisposition to break down due to adequate closure. Pledgets are often needed, as