Laparoscopic Repair of Large Type III Hiatal Hernia: Objective Followup Reveals High Recurrence Rate

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Background: Recent studies based on symptomatic outcomes analyses have shown that laparoscopic repair of large type III hiatal hernias is safe, successful, and equivalent to open repair. These outcomes analyses were based on a relatively short followup period and lack objective confirmation that the hernia has not recurred. The aim of this study was to compare the outcomes of laparoscopic and open repair of large type III hiatal hernia using both symptomatic evaluation and barium study to assess the integrity of the repair.

Study Design: Fifty-four patients underwent repair of a large type III hiatal hernia between 1985 and 1998. The surgical approach was laparotomy in 13, thoracotomy in 14, and laparoscopy in 27. An antireflux procedure was included in all patients. Symptomatic outcomes were assessed using a structured questionnaire at a median of 24 months and was complete in 51 of 54 patients (94%). A single radiologist, without knowledge of the operative procedure, assessed the integrity of the repair using video esophagram. Videos were performed at a median of 27 months (35 months open and 17 laparoscopic) and were completed in 41 of 54 patients (75%).

Results: Symptomatic outcomes were similar in both groups with excellent or good outcomes in 76% of the patients after laparoscopic repair and 88% after an open repair. Herniation was present in 12 patients and was asymptomatic in 7. A recurrent hernia was present in 12 of the 41 patients (29%) who returned for a followup video esophagram. Forty-two percent (9 of 21) of the laparoscopic group had a recurrent hernia compared with 15% (3 of 20) of the open group (p < 0.001 log-rank value on recurrence-free followup).

Conclusions: Laparoscopic repair of type III hiatal hernias is associated with a disturbingly high (42%) prevalence of recurrent hernia. More than half such recurrences have few, if any, symptoms. (J Am Coll Surg 2000;190:553–561. © 2000 by the American College of Surgeons)

Herniation of a portion of the stomach through the esophageal hiatus into the posterior mediastinum is a common affliction of modern humans. Hiatal hernias are classified into three types according to their anatomic characteristics. Type I hernias include the common sliding hiatal hernia, in which there is a dome-shaped upward migration of the gastroesophageal junction into the posterior mediastinum. Type II, or true paraesophageal hernias, have no sliding component and are characterized by a normally positioned gastroesophageal junction with herniation of the gastric fundus into the mediastinum alongside the esophagus. They are uncommon. Type III hernias, or mixed hernias, have both a significant sliding component and a paraesophageal component. Most so-called “paraesophageal” hernias are the mixed type (Fig. 1). Type III hernias tend to be large, and repair has been advocated regardless of symptoms because of the potential for life-threatening complications such as incarceration and strangulation.1,2

Recent reports have suggested that type III hernias can be adequately treated by the laparoscopic approach, and that the repair is successful in most patients.3-7 Few of these reports contain objective documentation of the success of hernia repair and most have based their conclusions on short-term

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symptomatic follow-up. The purpose of this study was to compare the outcomes of laparoscopic and open repair of large type III hiatal hernias using both symptomatic evaluation and radiographic barium studies to assess the integrity of the repair.

**METHODS**

Fifty-four patients with type III hiatal hernias underwent primary repair between January 1985 and May 1998. Two patients died from unrelated causes during the follow-up period, one of whom had responded to a symptom questionnaire. One patient was lost to follow-up. The surgical approach was transthoracic in 14, transabdominal in 13, and laparoscopic in 27. The median age of the laparoscopic group was 68 years (range 42 to 83 years) and of the open group, 66 years (range 39 to 80 years). There were 18 men and 36 women. Preoperative evaluation included video barium esophagram in 50 of 54 patients (93%), upper endoscopy in 52 (96%), esophageal manometry in 51 of 54 patients (95%), and 24-hour ambulatory pH monitoring in 44 of 54 patients (81%). Hernia size was measured radiographically. The sliding component was taken as the distance from the radiographic hiatus to the gastroesophageal junction and the paraesophageal component as the distance from the hiatus to the top of the fundus (shown in Fig. 1). Preoperative lower esophageal sphincter characteristics, manometric esophageal length, esophageal body motility, 24-hour pH scores, and radiographic hernia sizes were similar in both groups (Table 1).

**Surgical technique**

All but one of the operations were carried out electively. The only emergency operation was by laparotomy in a 75-year-old woman who had intermittent obstructive symptoms, but in whom the hernia was easily reduced to reveal a healthy and well-perfused stomach. Fifty-two patients had a Nissen fundoplication, one had a Collis gastroplasty and partial fundoplication, and one had a Toupet hemifundoplication, both performed by laparotomy. Surgical principles, irrespective of approach, included reduction of the hernia, complete excision of the sac, primary closure of the crura, and an antireflux procedure. In the laparoscopic group, the sac was completely removed from the crura but not excised from its attachments at the gastroesophageal junction. The crura were approximated posterior to the esophagus with a median of 7 (range 3 to 9) crural sutures. Pledgets were occa-

![Figure 1. Type III mixed hiatal hernia, arrow showing the gastroesophageal junction and dashed line the hiatus.](image)
sionally used to aid crural suture placement. No objective measure of crural tightness was used. No mesh or prosthesis was used in any patient. Gastroscopy was not part of the procedure.

Symptomatic followup
Symptomatic followup was completed in 94% of the patients (51 of 54 patients). All patients were seen in person or contacted by telephone and responded to a structured questionnaire. Questionnaires were completed in 25 of 27 patients in the open group at a median of 34 months (range 4 to 166 months) and in 26 of 27 patients in the laparoscopic group at a median of 17 months (range 5 to 49 months). Symptomatic outcomes were graded as excellent if the patient was asymptomatic, good if there was overall symptomatic improvement but minor gastrointestinal symptoms were present that did not require medication for relief, fair if there was overall symptomatic improvement but gastrointestinal symptoms were present that required medication for relief, and poor if the symptoms were the same as or worse than before operation.

Radiographic followup
Forty-one of 54 patients (75%) agreed to followup radiographic examination. Video esophagrams were performed according to a protocol of five swallows of liquid barium followed by a solid barium bolus meal; anteroposterior and oblique views were obtained in the upright and supine positions. All videos were reviewed on two separate occasions 3 months apart by an experienced esophageal radiologist who was unaware of the type of operative procedure performed. Video esophagrams were completed in 20 of 27 patients (74%) in the open group at a median of 35 months (range 4 to 166 months) and in 21 of 27 patients (77%) in the laparoscopic group at a median of 17 months (range 5 to 45 months). Figure 2 shows the times of followup video esophagrams. Anatomic recurrence was defined as any evidence of herniation of the stomach above the level of the diaphragm. Disruption of the fundoplication alone with no reherniation was noted but not classified as a recurrence. Radiologic confirmation of an intact fundoplication and crural repair was based on the presence of the following features: a central luminal narrowing with symmet-

![Figure 2. Distribution of time for followup video esophagrams. LAP, laparoscopy.](image)

Table 2. Symptomatic Outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Laparoscopic (%)</th>
<th>Open (%)</th>
<th>Overall (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 26</td>
<td>n = 25</td>
<td>n = 51</td>
</tr>
<tr>
<td>Excellent</td>
<td>46</td>
<td>64</td>
<td>55</td>
</tr>
<tr>
<td>Good</td>
<td>31</td>
<td>24</td>
<td>27</td>
</tr>
<tr>
<td>Excellent/good</td>
<td>77</td>
<td>88</td>
<td>82</td>
</tr>
<tr>
<td>Fair</td>
<td>19</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Poor</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Fair/poor</td>
<td>23</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Satisfied</td>
<td>96</td>
<td>96</td>
<td>96</td>
</tr>
</tbody>
</table>
outcomes and 9 had fair or poor outcomes. Eighty-eight percent (22 of 25) of the open group had good to excellent outcomes compared with 77% (20 of 26) in the laparoscopic group. When asked, 49 patients (96%) were satisfied with the outcomes of their procedure. Symptoms correlated poorly with the presence or absence of a recurrent hernia. Ten of the 42 patients with relief of their symptoms had radiologic evidence of either reherniation (7 of 42 patients) or wrap disruption (3 of 42), and 5 of the 9 patients with persistent symptoms had no evidence of recurrence on imaging. One patient in the laparoscopic group and one in the open group required postoperative dilatation.

Recurrent hernia

A recurrent hernia was present in 12 of the 41 patients (29%) who returned for a followup video esophagram. Reherniation and disruption of the fundoplication were present in nine and reherniation with an intact fundoplication in three. Disruption alone was seen in three patients (7%).

Forty-two percent (9 of 21) of the laparoscopic group had a recurrent hernia compared with 15% (3 of 20) of the open group (p < 0.001 log-rank value on freedom from recurrence at followup). Kaplan-Meier estimates of recurrence-free proportions are shown in Figure 3. The surgical approach was transabdominal in two and transthoracic in one of the three patients found to have recurrence after open procedure, and these failures were detected on videos carried out at 30, 35, and 64 months after operation. The longest video followup for the open group was 166 months. Failure after laparoscopic repair was detected on videos performed at 5, 11, 12, 14, 21, 27, 41, and 45 months after operation. The longest video followup for the laparoscopic group was 45 months. No difference in the prevalence of recurrent hernia was found when the first 10 operations (both open and laparoscopic) were compared with the last 10.

Univariate analysis of potential risk factors associated with recurrent hernia failed to find any significant factor independent of the operative approach. Specifically, neither age, gender, presenting symptoms, manometric esophageal length, 24-hour pH score, nor hernia size significantly affected the outcomes. The prevalence of erosive esophagitis was higher in the laparoscopic group, but this difference was not statistically significant and no increased risk of reherniation was imparted by the presence of esophagitis. Two patients in the laparoscopic group had long segment Barrett’s esophagus; one of these patients developed a recurrent hernia.

Operative morbidity

One patient died of respiratory failure after open transabdominal repair. She was a 67-year-old woman with preexisting asthma and end-stage pulmonary disease, whose operation was uneventful. Major complications occurred in seven patients and minor complications in six (Table 3). There was no difference in morbidity and mortality between the open and laparoscopic groups. Two patients were converted from laparoscopic to open, one because of esophageal shortening and one after developing pericardial tamponade. Median hospital stay, days until removal of nasogastric tube, and mean operative times for the three procedural groups are given in Table 4. There was a significantly shorter time of nasogastric intubation (p < 0.001) and a shorter hospital stay in the laparoscopic group (p < 0.001) versus the open group.

DISCUSSION

This study has identified a disturbingly high prevalence of recurrent hernia on radiographic investigation of patients after laparoscopic repair of large type III hiatal hernias. Nearly half of the patients returning for video esophagram after laparoscopic repair during a followup period of 5 to 45 months (median 17 months) were found to have a recurrent hernia.
hernias. Most of these reherniations were asymptomatic and would not have been detected otherwise. This compares with a 15% prevalence of recurrent hernia over a followup period of 4 to 166 months (median 34 months) in patients having open repairs. The only factor associated significantly with reherniation was the type of surgical approach.

Because patients were not followed routinely by esophagram, we know only that hernia recurrence occurred on or before the date of the study. This could result in bias favoring the open group by virtue of its longer average followup. In an effort to detect if this bias affected our conclusions, we compared freedom from recurrence between the two groups, assuming the open group failed very early (any observed reherniation had recurred by the end of the first postoperative year) and the laparoscopic group as late as possible (ie, on the date of the video examination). This analysis would minimize the effects of varying lengths of followup on the Kaplan-Meier estimates of freedom from recurrence. Despite this hypothetical analysis, a significant difference in the prevalence of recurrence-free patients favoring the open group remained.

Current literature states that laparoscopic repair of paraesophageal hiatal hernias is highly successful (Table 5). Most authors report symptomatic improvement in 80% to 90% of patients and less than 10% to 15% prevalence of recurrent hernia. The problem of recurrent hernia after laparoscopic repair of any hiatal hernia is becoming increasingly appreciated. Recurrent hernia is now the most common cause of anatomic failure after laparoscopic Nissen fundoplication done for gastroesophageal reflux disease (GERD). Cornwell and colleagues compared the reasons for failure in patients after laparoscopic and open Nissen fundoplication for GERD. The reasons for failure were significantly different. Failures after laparoscopic fundoplication were largely from recurrent hernia (11 of 16 patients); failures after open fundoplication were from wrap disruption or slippage or too long or tight a fundoplication (9 of 10 patients). Soper and Dunnegan likewise found recurrent hernia to be the most common cause of anatomic fundoplication failure. Why this is so is unclear. It may be because of the selection of a laparoscopic approach in patients with a shortened esophagus; lack of, or breakdown of the crural closure; less extensive esophageal mobilization; or a reduced tendency for adhesion formation after laparoscopic compared with open surgery. Horgan and colleagues have concluded that the most important technical factors preventing recurrence in the setting of reflux disease were effective crural closure, transhiatal esophageal mobilization, attention to the geometry of the fundoplication, and anchoring the wrap to the esophagus and surrounding tissues.

The problem of recurrent hernia after repair of large type III hiatal hernias has received less attention. Outcomes after repair of these hernias are usually based on symptomatic assessment alone. Al-

<table>
<thead>
<tr>
<th>Complication</th>
<th>Laparoscopic (n = 27)</th>
<th>Open (n = 27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td>Urinary tract infection (n = 2) Left basal atelectasis</td>
<td>Cellulitis of wound Skin wound dehiscence Atrial fibrillation</td>
</tr>
<tr>
<td>Major</td>
<td>Exacerbation of COPD and pneumonia</td>
<td>Hemothorax from bleeding intercostals requiring repeat thoracotomy Pleural effusion Cardiorespiratory failure</td>
</tr>
<tr>
<td></td>
<td>Hemothorax*</td>
<td>Retroperitoneal bleed*</td>
</tr>
<tr>
<td></td>
<td>Cardiac tamponade (conversion from laparoscopic to open)</td>
<td>Pneumonia</td>
</tr>
</tbody>
</table>

*In the same patient.

Table 4. Perioperative Course

<table>
<thead>
<tr>
<th>Variable</th>
<th>Laparoscopic</th>
<th>Open</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating time (min)</td>
<td>184</td>
<td>176</td>
<td>NS</td>
</tr>
<tr>
<td>Time to oral diet (d)</td>
<td>1</td>
<td>3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hospital stay (d)</td>
<td>3</td>
<td>9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mortality</td>
<td>0</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Major complications*</td>
<td>3</td>
<td>4</td>
<td>NS</td>
</tr>
</tbody>
</table>

*Number of patients with complications. NS, not significant.
though recurrence rates of 6% to 13% have been reported, they have largely been based on the need for reoperation or investigations that are performed on a selective basis. A problem is that most studies include pure type II hernias, which may have a significantly different propensity for reherniation given the unaltered location of the gastroesophageal junction. Wu recently reported 38 patients who underwent repair for type II and type III hernias, 35 of whom had postoperative endoscopic or radiographic examinations. At a followup of 3 months or more postoperatively, some degree of anatomic recurrence was noted in 23% of patients who underwent laparoscopic repair of their hernia. He also found no relationship of operative variables to the prevalence of hernia recurrence.

The principles of laparoscopic repair of a large intrathoracic hernia are analogous to those for an open procedure, namely reduction of the hernia, excision of the peritoneal sac, crural repair, and fundoplication. But there are several factors that make laparoscopic repair of these large hernias complex. First, volvulus of the stomach is often associated with these hernias and makes identification of the anatomy, in particular the location of the gastroesophageal junction. Wu recently reported 38 patients who underwent repair for type II and type III hernias, 35 of whom had postoperative endoscopic or radiographic examinations. At a followup of 3 months or more postoperatively, some degree of anatomic recurrence was noted in 23% of patients who underwent laparoscopic repair of their hernia. He also found no relationship of operative variables to the prevalence of hernia recurrence.

The possibility that esophageal shortening contributed to the development of recurrent hernia deserves consideration. The presence of esophageal shortening is almost certainly a factor responsible for recurrent hernia formation in patients with large type I hiatal hernias. In the setting of GERD, most authors have identified a 3% to 5% or higher prevalence of the need for Collis gastroplasty to achieve a tension-free intraabdominal repair. Although it is possible that esophageal shortening is a contributing factor in patients with large type III hernias, only one of the patients in the present study required esophageal lengthening.

### Table 5. Review of Reported Outcomes of Laparoscopic Repair of Paraesophageal Hernias

<table>
<thead>
<tr>
<th>Lead author</th>
<th>Year</th>
<th>n</th>
<th>Fundoplication (%)</th>
<th>Mean followup (mo)</th>
<th>Morbidity (%)</th>
<th>Excellent/good symptomatic outcomes (%)</th>
<th>Hernia recurrence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oddsodottir</td>
<td>1994</td>
<td>10</td>
<td>90</td>
<td>9</td>
<td>20</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>Pitcher</td>
<td>1995</td>
<td>12</td>
<td>60</td>
<td>8</td>
<td>25</td>
<td>83</td>
<td>0</td>
</tr>
<tr>
<td>Willekes</td>
<td>1996</td>
<td>30</td>
<td>76</td>
<td>—</td>
<td>27</td>
<td>—</td>
<td>0</td>
</tr>
<tr>
<td>Casabella</td>
<td>1996</td>
<td>15</td>
<td>100</td>
<td>—</td>
<td>20</td>
<td>100</td>
<td>—</td>
</tr>
<tr>
<td>Trus</td>
<td>1996</td>
<td>76</td>
<td>95</td>
<td>—</td>
<td>28</td>
<td>—</td>
<td>5</td>
</tr>
<tr>
<td>Perdikis</td>
<td>1997</td>
<td>65</td>
<td>100</td>
<td>18</td>
<td>14</td>
<td>92</td>
<td>3</td>
</tr>
<tr>
<td>Gantert</td>
<td>1997</td>
<td>55</td>
<td>73</td>
<td>10</td>
<td>16</td>
<td>—</td>
<td>3</td>
</tr>
<tr>
<td>Wu</td>
<td>1999</td>
<td>38</td>
<td>100</td>
<td>12</td>
<td>16</td>
<td>79</td>
<td>23*</td>
</tr>
</tbody>
</table>

*On videos conducted at 3 to 5 months.
ates reported a similar experience. Forty-seven of 52 patients with large type III hiatal hernias were successfully repaired by the transthoracic approach without the need for Collis gastropasty. Properly designed approach. This provides unimpaired esophageal mobilization from the hiatus to the aortic arch and gives ideal exposure for a firm closure of the esophageal hiatus.

References

Invited Commentary

Frederick L Greene, MD, FACS
Charlotte, NC

I congratulate Dr Hashemi and his colleagues from the University of Southern California for their presentation and important contributions both today and in the past regarding the management of esophageal disease. It was also a pleasure for me to review the manuscript. These authors have recognized the importance of followup in elucidating anatomic concerns regarding the repair of combined type III hiatus hernias, which are performed using a laparoscopic approach. This retrospective study has compared patients undergoing laparotomy, thoracotomy, and laparoscopy for the management of this illness. As others before them, these authors have correctly assumed that symptomatic well-being bears little or no relationship to anatomic disruption after hiatus hernia repair. The gold standard in this particular report has been the video esophagram, which was used to report anatomic recurrence. As you have heard, contrast studies were completed in 75% of the patients operated on. More specifically, 20 of 27 patients undergoing open repair had contrast studies, and 21 of 27 (77%) of patients in the laparoscopic group were studied radiologically. Based on these studies, a total recurrence rate of 29% was identified. The key point in this report is that 42% of the laparoscopic group developed a recurrent hernia as compared with only 15% of the group undergoing open procedures.

The authors admonish all of us to perhaps rethink our approach to patients with type III hiatus hernias as we consider a surgical approach. My concern with this report is certainly not in the data presented, but is based on the patients not studied. In the total group, 13 patients (24%) had no followup esophagram. This is in contrast to the fairly complete assessment of symptoms where 94% of the group was queried. Although appropriate Kaplan-Meier curves may be constructed, the true statistical evaluation may be in the confidence intervals generated. The strength of the authors’ conclusions may, in fact, be significantly changed if all patients were studied by contrast postoperatively. Confidence intervals for the data presented range from 20.4% to 61.4% recurrence rates. If one constructs a best-case scenario for the laparoscopically approached patients and assumes that the six patients not undergoing contrast studies had no recurrence, then the confidence intervals range from 14.8% recurrence to 49.4%.

Although it may be difficult to adequately discuss a learning curve for the 27 patients undergoing laparoscopic repair, I ask the authors to indicate whether the patients having recurrence were early or later in their operative experience. In addition, when discussing patients with type III herniation, the detrimental effect of the short esophagus has been frequently mentioned as a potential cause for recurrence. I would like the authors to comment on this hypothesis and to indicate their approach if a shortened esophagus is noted on preoperative evaluation. Finally, from this discussion, it is evident that postoperative evaluation of patients with this process should include a routine contrast study. Would the authors comment on the timing of such a study, which would give the most significant results in relation to recurrence.

It has been a pleasure to have the opportunity to discuss this work. The authors present a challenge to all of us to carefully assess our outcomes and to report our successes and failures.

Reply

Jeffrey H Peters, MD, FACS
Los Angeles, CA

Thank you, Dr Greene, for your kind comments and insightful questions.

The study is indeed retrospective and suffers from all of the problems and biases associated with a retrospective study. With that being said, however,