A 25-year experience with open primary transthoracic repair of paraesophageal hiatal hernia

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Objective: The optimal surgical treatment of paraesophageal hiatal hernia is in debate. Our experience with a traditional transthoracic approach was reviewed to provide “benchmark” data against which newer surgical techniques can be measured.

Methods: Between 1977 and 2001, 240 patients had primary transthoracic repair of paraesophageal hiatal hernia. Presenting complaints included reflux (69%), pain (67%), dysphagia (36%), and bleeding or anemia (33%). Preoperative esophageal function testing showed abnormal reflux in 86%. Hernia types were combined (type III) in 92% and type IV in 8%. All patients had reduction of the hernia and a concomitant antireflux procedure. An esophageal lengthening Collis gastroplasty was performed in 96%.

Results: There were 3 perioperative deaths (1.7%). The median length of hospital stay was 7 days. Early complications requiring reoperation occurred in 12 patients (5%) and included recurrent hernia in 4, leak in 3, and a tight hiatal closure in 3. Mean follow-up in 226 patients was 42 months (median 27.8 months). Satisfactory results were obtained in 86% of patients. Follow-up complaints (moderate or persistent symptoms) included dysphagia (4), reflux (1), dumping (3), and post-thoracotomy pain (1). Routine postoperative barium radiographs showed intact repair in 71% (108/153). Of 19 patients with an anatomic recurrence, 4 (2%) had more than a partial asymptomatic migration of the fundoplication and required reoperation. Postoperative esophageal function testing, obtained in 28% of the patients, showed abnormal gastroesophageal reflux in 2.

Conclusion: Open transthoracic repair of paraesophageal hiatal hernia provides good to excellent long-term control of both the hernia and gastroesophageal reflux with relatively low early morbidity.

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Gastric herniation through the esophageal hiatus has typically been described as 1 of 2 major types.¹⁻⁴ In the more common sliding hiatus hernia (type I), representing approximately 95% of all hiatal hernias, the gastroesophageal (GE) junction is herniated into the thorax and is the leading point of the hernia. Paraesophageal hiatal hernias (PH), on the other hand, are characterized by herniation of the fundus of the stomach through the esophageal hiatus alongside the lower esophagus. With a type II or “pure” paraesophageal hernia, the GE junction maintains its position fixed posteriorly at the hiatus while the fundus herniates into the chest through the anterolateral hiatus. “Pure” type II PH seldom occurs. The vast majority of PH are the “combined” hernias (type III) in which the cardia is herniated above the diaphragm (but is not the leading point of the hernia) and the fundus has herniated alongside the esophagus as well. With the type IV hernias, other organs in

addition to the stomach (colon, small intestine, spleen) are also present in the sac. The most important clinical difference between the 2 major types of hiatus hernias relates to their potential complications. PH (types II, III, and IV) are more likely to present with gastric volvulus, incarceration, strangulation, and ulceration than are sliding hernias.¹

There has been persistent controversy regarding the optimal surgical treatment of PH.^{1,-3,5-21} Therapeutic debates occur over the approach to repair (transthoracic or transabdominal), the need for an associated antireflux procedure, and finally the assessment of esophageal length. Recently, there has been considerable interest in the laparoscopic repair of paraesophageal hernias.^{11-20,22} Special considerations with the laparoscopic approach include the unique technical difficulties encountered and the steep learning curve associated with this procedure. In addition, the presence of a pneumoperitoneum and its subsequent displacement of the diaphragm to a more cephalad location make the intraoperative assessment of esophageal length more difficult. Finally, the performance of an esophageal lengthening procedure from the abdomen can itself be quite difficult. Several recent studies have demonstrated the feasibility of laparoscopic repair of PH, but the durability of these repairs with short-term follow-up is still under debate.^{11-20,22}

This study was undertaken to review our 25-year experience with traditional transthoracic repair of paraesophageal hernias. The preoperative presentation, intraoperative course, and postoperative follow-up reported in this study demonstrate the excellent results that can be obtained with an open transthoracic repair of PH and serve as a benchmark against which minimally invasive approaches should be compared.

Patients and Methods

The medical records of 240 consecutive patients who had a primary transthoracic repair of a paraesophageal hernia on the University of Michigan Thoracic Surgery Service between March 1977 and September 2001 were reviewed retrospectively. The diagnosis was established on the basis of characteristic barium swallow or intraoperative findings at the time of emergency repair. All patients had a concomitant antireflux procedure in conjunction with reduction of the hernia. Preoperative evaluation included clinical history and physical examination, barium swallow in 235 (98%) patients, and esophageal function testing (EFTs), both manometry and standard acid reflux test in 77 (32%) patients, and esophagoscopy when possible at the time of hernia repair. As described previously, the standard acid reflux test (SART) involves documentation of abnormal gastroesophageal reflux using an intraesophageal pH probe positioned 5 cm above the lower esophageal sphincter. Abnormal reflux can then be documented after placement of 300 mL bolus of 0.1 N hydrochloric acid in the stomach and conduction of a series of standardized postural maneuvers to elicit reflux.²³ The intraoperative and postoperative courses were reviewed. Postoperative follow-up was obtained with a combination of history and physical examination, barium swal-

low, EFT, and personal telephone interviews (asking specifically for symptoms of dysphagia, dumping, reflux, post-thoracotomy pain, early satiety, or the need for dilatations). Follow-up of any type could not be obtained in 14 patients. This study was approved by the Institutional Review Board of the University of Michigan Medical Center.

Clinical Features

Of the 240 patients with PH, 72 were men (30%) and 168 were women. The average age of these patients was 65.3 years (range 29-94 years). The average body mass index (BMI) was 30, with 115 (71%) classified as obese (BMI 25-35) and another 25 (15%) classified as morbidly obese (BMI > 35). Reflux symptoms and abdominal or chest pain occurred in 165 (68%) and 161 (67%) patients, respectively. Other common clinical features included a history of bleeding or anemia in 80 (33%) and dysphagia in 87 (36%). Five patients (2.1%) had surgery in an emergency or urgent setting for symptoms of incarceration. Only 1 patient had an asymptomatic paraesophageal hernia. Forty-eight (20%) had a history of hernias in other locations (eg, umbilical, ventral, inguinal).

Preoperative EFT was performed routinely only in the early part of this series. The results of EFTs obtained in 77 patients (32%) revealed dysmotility in 19 (25%) and abnormal reflux (2 to 3+) in 66 (86%). Preoperative barium swallow showed characteristic findings of PH in all 235 in whom studies were available; there was radiographic reflux in 9%, stricture in 3%, and dysmotility in 14%. Type III hernias were most common (220 patients, 91.7%); type IV hernias were seen in 20 (8.3%). There were no pure type II hiatal hernias in this series. The results of preoperative upper endoscopy were available in 218 patients (91%) and indicated esophagitis in 35 (16%), Barrett's-type epithelial changes in 11 (5%), and strictures in 6 (2.8%). The esophagogastric junction measured at preoperative endoscopy was located at an average of 33.6 cm from the upper incisors (range 25-45 cm).

Surgical Features

Based upon the potential for serious mechanical complications (strangulation, perforation, or bleeding), the indication for operation in all patients was the presence of a PH in a patient judged to be physiologically fit for surgery. The operative approach was through a left thoracotomy in the sixth or seventh interspace. An antireflux procedure was performed routinely. An esophageal lengthening Collis gastroplasty was performed in all patients in whom at operation the GE junction could not be reduced below the diaphragm without undue tension. The antireflux procedures performed included a combined Collis-Nissen operation in 231 (96%), a Nissen fundoplication in 8 (3%), and a Belsey Mark IV repair in 1. Our technique of the combined Collis gastroplasty-Nissen fundoplication has been described previously.^{3,4} Additional procedures performed in 11 patients included left lobectomies for bronchogenic carcinoma in 2, esophagomyotomy for associated achalasia in 1, splenectomy for a splenic artery aneurysm in 1, repair of a Zenker's diverticulum in 1, repair of Zenker's diverticulum and umbilical hernia repair in 1, and cholecystectomy in 2 (through a separate abdominal incision). One patient had Barrett's mucosa and had a concomitant mucosectomy. Intraoperative dilatation of a stricture was performed in 2 patients.

Statistics

All values are expressed as the mean. Median values and associated ranges are given where appropriate. Preoperative to postoperative changes in variables were assessed using a McNemar's test or paired Student *t* test where appropriate.

Results

There were 3 hospital deaths (1.7% operative mortality, Table 1). Intraoperative complications occurred in 3 patients (1.3%, Table 1). Major postoperative complications occurred in 20 patients (8.5%, Table 1). Of these, 12 (5%) required reoperation during the immediate postoperative period for early anatomic recurrence of the hernia in 4 (1.6%), excessive narrowing of the hiatus in 3, and postoperative hemorrhage in 1. Another 2 patients (0.8%) developed empyemata, presumably from occult esophageal leaks, and required decortication. One patient required reoperation for a symptomatic dislocated costal arch. Another patient experienced a myocardial infarction and developed a pericardial effusion that required pericardiocentesis. This patient developed tamponade following the pericardiocentesis and required a sternotomy for control. One patient with an early anatomic recurrence of the hernia had reduction of the recurrence but then had a distal esophageal leak and required subsequent esophagectomy.

There were 6 patients who had further surgery long after their initial PH repair. Late recurrent herniation occurred in 4 patients, and repeat repair was done at 13, 16, 26, and 51 months. Two patients developed stenosis at the GE junction and required subsequent esophagectomy for relief of dysphagia. One patient who had Barrett's mucosa and who had a mucosectomy at the time of his PH repair presented 46 months later on routine surveillance endoscopy with high-grade dysplasia; he then had a transhiatal esophagectomy. One patient with severe postoperative dysphagia from a narrowed GE junction was not operated on because he had known metastatic insulinoma.

Length of follow-up in 222 patients (94%) ranged from 1 month to 17 years (average 42 months). Follow-up was no different in those who with normal BMIs (<25) or those who were obese (BMI > 25, *P* = .42). Of these patients, 192 (85%) were satisfied with the results of their operation at last follow-up. Symptoms (occasional, intermittent, or persistent) at last follow-up included dysphagia in 49 (*P* < .01 vs preoperative), reflux in 11 (*P* < .01 vs preoperative), dumping symptoms in 25, early satiety in 17, and post-thoracotomy pain in 34. The majority of these patients had very occasional symptoms. At the time of last follow-up, severe symptoms included dysphagia in 4, reflux in 1, dumping in 3, early satiety in 2, and pain in 1.

We have long utilized dilatational therapy in any patient reporting even occasional "sticking of food" after esophageal surgery. With this liberal policy, 69 patients (31%) had

TABLE 1. Complications after transthoracic PH repair*

	Number of patients
Mortality (1.7%)	
Myocardial infarction, cardiogenic shock	2
Atrial fibrillation, large stroke, care withdrawn	1
Intraoperative complications (1.7%)	
Vagus nerve injury	2
Splenic laceration	1
Major postoperative complications (8.5%)	
Esophageal leak/empyema; reoperation	2
Hemorrhage; reoperation	1
Early anatomic recurrence; reoperation	4
Tight hiatal closure; reoperation	3
Dislocated costal arch; reoperation	1
Myocardial infarction	3
Stroke	2
Prolonged ventilatory support	4
Deep venous thrombosis	2
Pneumonia requiring ventilatory support	2
Congestive heart failure	2
Colonic ileus (prolonged hospitalization)	1
Minor postoperative complications (13.8%)	
Asthmatic exacerbation (mild)	1
Pneumonia (mild)	3
Pancreatitis (mild)	1
Large pleural effusion; thoracentesis	1
Wound infection	2
Dysphagia (requiring dilation)	16
Delayed gastric emptying or ileus (mild)	8
Arrhythmia	5
Peroneal nerve injury	1
Urinary tract infection	6

*For the sake of completeness, complications resulting in mortality (eg, myocardial infarction) are listed again. Multiple complications also occurred in a single patient (eg, prolonged ventilatory support and congestive heart failure or urinary tract infection and dysphagia needing dilation).

dilatation therapy following surgery. Of these, however, only 19 (8%) received multiple (>2) dilations.

Routine barium radiography was obtained prior to discharge in all patients to ensure a proper intra-abdominal length of the fundoplication and integrity and adequate emptying of the esophagus. Of the 193 patients with available reports, 77% had a satisfactory postoperative appearance. Delayed esophageal emptying was seen in 17% and dysmotility in 5%. Four patients had early anatomic recurrence (upward migration of the fundoplication through the disrupted crural repair) prior to discharge, and all 4 were reoperated on. In 1 of these, at reoperation, a hiatal stitch had untied (technical error), and in the remaining 3, the medial crus of the diaphragm was found to have torn away from the hiatal stitches. Of the 32 patients with delayed emptying on predischARGE radiography, only 9 (28%) had symptoms of dysphagia at their last follow-up. The median length of stay was 7 days (range 4-50 days).

Routine postoperative barium swallows are obtained at 1-, 3-, and 5-year intervals after surgery. Such follow-up barium swallows were obtained after discharge in 153 patients, after a mean time of 29 months (range 2 months to 17 years). Of these, 108 (71%) had a satisfactory appearance at last follow-up. Radiographic reflux was seen in 7 patients, anatomic recurrence in 19 (10%), dysmotility in 33 (tertiary contractions in 19), and delayed emptying in 14. Among the 19 patients with anatomic recurrences of their hernias due to partial upward migration of the fundoplication through the hiatus, reoperations were required in 4 who were judged to have "fixed" hernias that constituted a potential risk of mechanical complications. Thirteen of the remaining patients with recurrences were asymptomatic; 2 reported occasional mild symptoms. But in these latter 15 patients, the radiographically evident partial migration of the fundoplication above the diaphragm was transient and intermittent, so a nonoperative course of conservative follow-up was chosen. Despite the report of delayed esophageal emptying on follow-up radiography in 14 patients, only 6 had symptoms of dysphagia (64-month mean follow-up in this subset).

Earlier in our experience (1977-1994), when we were initially assessing the efficacy of the Collis-Nissen repair in controlling reflux, postoperative esophageal function testing was performed in 67 of the patients (28%). Follow-up EFTs (manometry and SART) were obtained routinely every year for 5 years after surgery. The low incidence of abnormal reflux after the Collis-Nissen operation and consideration for patient comfort have prompted a much more selective performance of EFTs in recent years. Mean follow-up time was 29 months (range 1-63 months). Among these patients, 4 (6%) had evidence of abnormal reflux on standard acid reflux testing. Dysmotility was documented in 3 patients. Forty-five patients had both preoperative and postoperative EFTs performed. Reflux testing in this subset showed that 88% had preoperative abnormal reflux (2 to 3+); only 4% had it postoperatively. On esophageal manometry in this subset, 27% showed evidence of preoperative dysmotility, and only 7% showed dysmotility after surgery.

Discussion

The landmark report from Skinner and Belsey¹ on the surgical therapy of paraesophageal hiatal hernias showed a mortality rate of 27% in patients managed with observation. Since then, an aggressive surgical approach to treating PH to avoid life-threatening complications of gastric strangulation, perforation, and bleeding has been advocated by most authors.^{1,5,6,7,12} The indication for operative therapy in patients with PH in most series has been the presence of this fixed intrathoracic hernia with its potential for disastrous complications regardless of the size of the hernia.

The etiology of paraesophageal hernias is unknown, but because of their relative frequency in adults versus children, it is commonly believed that these are acquired rather than congenital abnormalities.^{2,6,7} Maziak and colleagues² suggested that PH are an advanced stage of a sliding hernia. Others argue that these are 2 distinct pathologic entities. Our data, showing essentially all of our paraesophageal hernia patients having combined sliding and paraesophageal hernias, suggest that PH is an acquired disease. However, since 20% of the patients in our series have had a history of other abdominal wall hernias (in contrast to prevalence estimates in all people of 5%-10%), PH may occur in those patients who have an anatomic or physiologic predisposition for hernia formation such as those who are obese or those who cough excessively due to chronic obstructive pulmonary disease.

Controversy exists regarding the various aspects of surgical management of PH. The optimal operative approach, whether transthoracic^{2,9,10} or transabdominal,⁵⁻⁷ has been debated extensively; the debate is still ongoing. Proponents of the transabdominal approach site the avoidance of a thoracotomy and its attendant morbidities as an advantage. Those advocating transthoracic repair emphasize the improved ability to resect the entire hernia sac and to more accurately assess esophageal length (and subsequent tension on the repair) with this approach. Our data show that transthoracic repair can be done with relatively low postoperative morbidity and compares favorably with other reports of transabdominal open and laparoscopic repair.^{1-3,5-20,22} Major postoperative complications, either requiring further surgery or resulting in mortality or significant morbidity (eg, myocardial infarction, cerebrovascular accident, or prolonged ventilatory support), occurred in 8.5% of our patients. A patient undergoing an uncomplicated transthoracic PH repair on our service in the last 5 years would typically resume a diet after 3 days and would be discharged from the hospital in 5 days without any stay in the intensive care unit.

Another debated aspect of the therapy of PH is the need for an antireflux procedure at the time of reduction of the hernia.^{1,2,5-10,12,14,16} Our experience, along with that of others, indicates that the majority of these patients present with symptomatic and objective evidence of gastroesophageal reflux. The majority of PH in our series, as well as others,^{2,9} were combined type III hernias, with the GE junction clearly above the diaphragm (sliding part) and the fundus herniated into the chest alongside the distal esophagus (paraesophageal part). In addition, during complete mobilization of the hernia sac and the herniated stomach (a surgical requisite in our opinion), destruction of the phrenoesophageal ligament and posterior esophageal attachments occurs by necessity and predisposes to reflux and recurrent herniation unless an antireflux procedure is performed. Only 1 of our patients (0.1%) complained of troublesome post-

operative reflux compared with 68% (165 patients) preoperatively. Objective (pH probe) evidence of reflux was also less in those patients who had both preoperative and postoperative EFTs (88% vs 4%, respectively). In contrast, Williamson and colleagues⁵ performed selective antireflux repairs and found an incidence of postoperative reflux of 18%. It is for these reasons that we advocate an antireflux procedure in all patients undergoing primary repair of PH.

Assessment of esophageal length—more specifically the presence of relative esophageal shortening, which may result in tension on the repair and jeopardize its long-term success—has been done by preoperative studies including barium radiography as well as upper endoscopy. Most definitive, however, is intraoperative assessment performed at the time of thoracic repair,^{2,9,10,21} which is surgeon-specific, subjective, and based upon judgment and experience. After complete mobilization of the hernia, it is our practice to gently grasp the GE junction with long forceps and reduce it beneath the diaphragmatic hiatus. With even the least sensation of tension in the distal esophagus remaining above the hiatus, we opt for an esophageal lengthening Collis gastroplasty, in a fashion similar to the justification for a “relaxing incision” in an inguinal hernia repair. Assessment of the presence of esophageal shortening is not readily done when the approach is transabdominal, because one has to pull down the stomach to visualize its most cephalad portion. The laparoscopic approach renders intraoperative assessment rather difficult because the associated pneumoperitoneum with laparoscopic repair shifts the diaphragm cephalad, giving the false impression of adequate esophageal length after mobilization. Further, the posterior crural closure, common to all hiatal hernia repairs, is more difficult in the PH patient. The hiatus is much more enlarged and its musculature more attenuated than with sliding hernias. There is a need to suture more substantial crural muscle further back from the edges of the hiatus and to place more crural sutures than with a sliding hernia repair. Such suturing of the crura is not as easy through an abdominal versus a transthoracic approach. Unappreciated tension on the repair and a suboptimal crural closure may both contribute to the relatively high recurrence rates reported in the short term after laparoscopic repair.^{13,15,19-21}

In our opinion, obesity is another relative indication for an esophageal lengthening procedure at the time of repair. There are several reasons for this. First, obese patients have a demonstrated predisposition to hernia formation at other sites in the abdominal wall (ie, groin, umbilical, incisional, or hiatal).²⁴ In our series, 20% of our patients had other hernias. Second, obese patients are at higher risk for subsequent breakdown of hernia repairs, regardless of the location of the hernia.²⁴ Finally, we have empirically noted a higher incidence of relative shortening of the esophagus in patients who are obese. The majority of our patients with

PH (86%) had BMIs that corresponded to the obese or morbidly obese range, in our opinion justifying an esophageal lengthening procedure in an effort to minimize tension on the repair.

Despite our liberal use of the esophageal lengthening procedure in repair of PH, we have experienced a 10% (23 of 240 patients) anatomic recurrence rate; 4 patients (2.6%) required reoperation. This still compares favorably with other reports of symptomatic recurrence rates of 3.5% to 29%.^{5,13,15,19-21} Fifteen of the 19 late anatomic recurrences represented asymptomatic partial migrations of the fundoplication above the diaphragm and required no further therapy. In the last 4 years, we have modified the Collis-Nissen PH repair to include 3 horizontal mattress sutures around the circumference of the hiatus between the fundoplication and the diaphragm to anchor the wrap beneath the diaphragm. The efficacy of this modification in reducing the anatomic recurrence rate is being assessed.

Follow-up of the subjective results in our patients indicates that the most common postoperative complaint after a Collis-Nissen repair was dysphagia for which an esophageal dilatation was performed in 69 (31%) patients. However, only 18 (8%) of these required more than 2 dilatations, the remainder reporting only occasional dysphagia at last follow-up. We utilize postoperative passage of esophageal dilators both therapeutically as well as diagnostically. Our indications for postoperative dilatation are liberal and include any degree of dysphagia, even rare “sticking of food.” Passage of Maloney dilators either at the bedside or in the clinic treats the dysphagia and also allows assessment of the degree of resistance (“tightness”) at the GE junction. Resistance as the dilator is passed may indicate too tight a fundoplication, overzealous narrowing of the hiatus, or too tight a gastroplasty tube. In most cases, no resistance is encountered as the dilators are passed, confirming local edema and spasm in the distal esophagus as the likely cause of transient early postoperative dysphagia. The Collis-Nissen procedure is performed with either a 54F- or 56F-sized dilator within the esophagus to prevent undue narrowing, and the length of the fundoplication is limited to 3 cm.³ Since 1985, when we reduced the length of the fundoplication from 6 to 3 cm, the proportion of patients requiring multiple dilations decreased from 12% to less than 8%.

In summary, a large series of primary repairs for HA using an open transthoracic approach has been reviewed. This study shows that this approach is safe and durable and provides a benchmark with which other therapies of paraesophageal hiatal hernias can be compared.

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Discussion

Dr James D. Luketich (Pittsburgh, Pa). Drs Patel, Orringer, Iannettoni, and colleagues are to be congratulated for making this significant contribution to the literature. The data on 240 patients presented here today represents the largest series on the management of paraesophageal hernias. The strengths of this study are obvious. This large group of patients was managed by a consistent

surgical approach including thoracotomy, Collis lengthening, and Nissen fundoplication in 96% of cases with low morbidity and a median follow-up of over 4 years. The authors report that 85% of patients were satisfied and had symptomatic improvement, with a total reoperation rate of 8.1%.

Only 1 other open series from Toronto has provided us with such consistent postoperative outcome data. These 2 benchmark studies on open surgical management both used Collis gastropasty and provide results for us to strive to attain in this era of minimally invasive surgery. Thus, it appears that with open surgery in experienced hands, the mortality should be less than 2%, with good outcomes in over 85%, and long-term reoperation rates in the range of 2% to 8%.

In our most recent series of 200 giant paraesophageals repaired laparoscopically with a Collis procedure, we were pleased to see that our intermediate results compare favorably with open standards. In our series the operative mortality rate was 0.5%, with a 2-day stay, low morbidity, and objective scores of good to excellent results in 92% of cases and a reoperative rate of 2.5%. This minimally invasive data will need to stand the test of time and the current open series provides important standards.

I have several questions. First, I would like you to more specifically define eligibility for this study. The title does not include the word "giant," and, as you mentioned in your manuscript, type III is a progression of type I. How did you specifically make your cutoff to avoid including the easier to manage type I sliding hernias? Did you specify a specific centimeter number, and how many patients had totally intrathoracic stomach?

Second, regarding follow-up, you mentioned 85% of patients were satisfied. Have you attempted to add more objectivity to this? For example, how many patients were back on proton pump inhibitors? Have you considered using a more standardized outcomes tool? For example, the heartburn-related quality-of-life score grades reflux severity and yields a reproducible score that standardizes what we define as satisfactory.

Finally, what is your current management and which approach would you use to operate on a paraesophageal hernia today: laparoscopic, thoracoscopic, open? And do you have a minimally invasive approach to esophageal lengthening?

Dr Patel. Dr Luketich, thank you for your kind comments and questions. We would like to take this opportunity to congratulate you on the excellent results that you have shown in recent meetings on your technique on the laparoscopic repair of paraesophageal hiatal hernias.

To answer the first question, in terms of the eligibility of this study, we see no difference between a giant paraesophageal hernia or a small paraesophageal hernia. The indications for surgery in this study was a diagnosis of paraesophageal hernia, regardless of the size of the hernia. We believe that a paraesophageal hernia itself is an indication for surgery because of the risk of complications that are associated with these hernias. These risks have clearly been shown in a number of studies, including the original landmark study by Skinner and Belsey in 1967. Pure sliding hernias were excluded in this study.

To answer the question about follow-up, our measurements of follow-up included questionnaires to all patients, which specifically asked whether or not they are satisfied with the result. We also looked at the incidence of common postoperative complaints,

including those of dysphagia, reflux, early satiety, and, finally, other evidence of dysmotility in these patients. We have not used a heartburn score or other types of scores in this study to ascertain good or excellent results. However, most of these patients in this study felt that they were satisfied with the results of the operation, and most of these patients would proceed with the surgery again if they had to. Current medication regimens such as use of proton pump inhibitors were not specifically addressed in this study. Rather, the presence of postoperative symptoms such as reflux or dysphagia were elicited from the patients. Finally, the number of patients with significant postoperative complaints is small.

With respect to your final question regarding the current management of paraesophageal hernias, we have no experience in approaching these paraesophageal hernias via minimally invasive methods, but certainly that is something that we are working toward.

Dr Claude Deschamps (*Rochester, Minn*). Dr Patel, you could call your paper also, “The good old days are back again.” I think that it’s wonderful to have a large series with very serious follow-up.

I have 2 questions. Does Dr Orringer still forbid you from doing laparoscopic esophageal surgery in your service? Second, were there any emergency cases in your series?

Dr Patel. Thank you for your questions. Dr Orringer does not forbid us to do laparoscopic surgery. In fact, he encourages it. As far as the number of patients who had urgent or emergency surgery, there were 5 patients who had urgent operations for symptoms of incarceration in our study.

Dr Scott J. Swanson (*New York, NY*). I may have missed this, but I think 1 of the key questions is how to determine when to lengthen the esophagus. There is much controversy. Some authors never do and some authors always do. How exactly do you determine that, and do you have any specific operative measures that would be helpful?

Dr Patel. I think that this is actually the key point in this talk. There are a number of methods of evaluating esophageal length. Other authors have suggested that preoperative endoscopy, for example, is a good tool. In 218 of the 240 patients in whom we have upper endoscopy results, the GE junction was measured at an average of 33.6 cm, suggesting shortening. We feel that barium swallow and preoperative upper endoscopy, while aiding or giving additional information, are not really the best tools for assessing shortening, and we feel that the assessment of shortening is best done intraoperatively. After full mobilization of the stomach and the esophagus, if the stomach cannot be reduced below the diaphragm without any tension, we feel that an esophageal lengthening procedure is indicated. In addition, another relative indication we have of lengthening is that of obesity. The average BMI in our series of patients was 30, with normal being less than 25. Approximately 70% presented with BMIs ranging from 25 to 35, which is the obese range, and another 15% presented with BMIs over 35, which is classified as morbidly obese. So in our series, we actually have a fairly liberal use of the Collis-Nissen fundoplication, but it was indicated in all of these patients for these reasons that I’ve noted.