Improved Outcome After Extended Gastric Myotomy for Achalasia

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Hypothesis: There is general agreement that a Heller myotomy should extend 6 to 7 cm above the gastroesophageal junction. Results of most previous studies have recommended that the myotomy extend 1 to 1.5 cm below the gastroesophageal junction. We speculated that the effectiveness of the operation could be improved if a longer, 3-cm myotomy was carried out below the gastroesophageal junction, as it would more completely obliterate the lower esophageal sphincter. We, therefore, changed our technique in 1998. Concurrently, we converted from a Dor fundoplication to a Toupet fundoplication. This study analyzes the results of our new strategy.

Design: A case series using a prospectively maintained database.

Setting: Tertiary referral center.

Patients: One hundred ten consecutive patients with achalasia undergoing laparoscopic Heller myotomy.

Intervention: We analyzed the course of 52 patients treated with a standard laparoscopic esophagogastric myotomy (1.5 cm in the stomach) and a Dor fundoplication between September 1, 1994, and August 31, 1998, and 58 treated with an extended gastric myotomy (3 cm below the gastroesophageal junction) and a Toupet fundoplication between September 1, 1998, and August 31, 2001.

Main Outcome Measures: Esophageal function testing (esophageal manometry and 24-hour pH monitoring), symptom questionnaire (frequency and severity), and postoperative interventions required.

Results: Postoperatively the lower esophageal sphincter pressure was significantly lower after extended gastric myotomy and a Toupet fundoplication vs standard myotomy and a Dor fundoplication (9.5 vs 15.8 mm Hg). Dysphagia was both less frequent (1.2 vs 2.1) and less severe (visual analog scale, 3.2 vs 5.3) after extended gastric myotomy and Toupet fundoplication. In the standard laparoscopic esophagogastric myotomy and a Dor fundoplication group, 9 patients (17%) had recurrent, severe dysphagia, which was treated by dilation in 5 patients and by reoperation in 4 patients. In the extended gastric myotomy and Toupet fundoplication group, 2 patients (3%) developed recurrent dysphagia that resolved with dilation. There were no reoperations in the extended gastric myotomy and Toupet fundoplication group. No difference was noted in the frequency of heartburn (1.3 vs 1.7), regurgitation (0.3 vs 0.8), and chest pain (0.3 vs 0.6), nor was there a difference between the 2 groups in proximal (1.7% vs 2.3%) and distal (6.0% vs 5.9%) esophageal acid exposure.

Conclusion: An extended gastric myotomy (3 cm) more effectively disrupts the lower esophageal sphincter, thus improving the results of surgical therapy for achalasia for dysphagia without increasing the rate of abnormal gastroesophageal reflux provided that a Toupet fundoplication is added.
approach was used and the fundus mobilized by dividing the fundus. We used a standard 5-port laparoscopic technique. The left crus was divided (manometry and 24-hour pH monitoring), 19 in the SM/Dor fundoplication group (median follow-up, 46 months; range, 1-85 months) and 50 in the EM/Toupet fundoplication group (median follow-up, 46 months; range, 1-38 months). Forty-three patients (75%) were available for clinical follow-up, 32 in the SM/Dor fundoplication group and 24 in the EM/Toupet fundoplication group. This testing was usually done 3 to 6 months postoperatively. Eighty-two patients were asked to fill out a questionnaire describing the frequency of symptoms once during the initial preoperative visit and again postoperatively. This questionnaire contained 2 groups of 11 questions. The first set of questions concerned esophageal and other gastrointestinal tract symptoms such as heartburn, regurgitation, dysphagia for solids or liquids, abdominal or chest pain, belching, bloating, nausea, odynophagia, and globus sensation. The second group of questions related to airway symptoms such as hoarseness, aspiration, wheezing, choking, coughing, dyspnea, sore throat, asthma attacks, bronchitis, and pneumonia. Symptoms were scored 0 to 4 according to frequency (0, never; 1, once a month; 2, once a week; 3, once a day; or 4, several times daily). Data from the questionnaire were used to populate our database. In addition, all patients were asked postoperatively to assess the severity of their dysphagia from 0 (normal or as when they were young and without dysphagia) to 10 (the worst ever or before any treatment for achalasia). Moreover, our database and the clinical records of these patients were queried with the specific aim of determining the form of treatment (if any) used to treat recurrence.

**Symptoms**

**Esophageal Manometry**

A water-perfused, 8-channel catheter (+ radial ports at the same level and 4 separated by 5-cm intervals) was used to assess LES and esophageal body function when the patient was in the supine position. The LES was examined using the 4 radial ports. A station pull-through measurement of the LES pressure (LESP) determined the characteristics of the sphincter. The LESP was averaged over a series of 3 respiratory cycles. The esophageal body was assessed over a minimum of 10 episodes of deglutition with 5-mL aliquots of water.

**24-Hour pH Monitoring**

Ambulatory 24-hour pH monitoring was performed using a dual-probe catheter. The distal probe was located 5 cm above the manometrically determined LES. The proximal probe was located 10 cm above the distal probe. A portable digital data logger (Medtronic Inc, Minneapolis, Minn) was used to record pH fluctuations while the patient recorded symptoms in an event.
Preoperatively, dysphagia, regurgitation, and chest pain all occurred with greater frequency in the EM/Toupet fundoplication group than in the SM/Dor fundoplication group (Table 1). Postoperatively, dysphagia frequency (1.2 vs 2.1, \(P = .001\)) and severity (visual analog scale, 3.2 vs 5.3, \(P = .001\)) were significantly lower in the EM/Toupet fundoplication group when compared with the SM/Dor fundoplication group. Regurgitation and chest pain frequency were similar between groups after the operation (Table 2). There was also no difference in the frequency of heartburn between those who underwent SM/Dor fundoplication (1.7) and those who underwent EM/Toupet fundoplication (1.3) (Table 2). Heartburn was significant enough to require antacid therapy in 14 patients (44%) in the SM/Dor fundoplication group and 11 patients (22%) in the EM/Toupet fundoplication group. The frequency of the other extraesophageal reflux-related symptoms (hoarseness, aspiration, wheezing, choking, coughing, dyspnea, sore throat, and bronchitis) were also similar (Table 2).

### MANOMETRY

Preoperatively, the average LESP was similar between the SM/Dor (35.5 mm Hg) and EM/Toupet (34.2 mm Hg) fundoplication groups (\(P = .73\)) (Table 1). Postoperatively, the LESP was significantly lower in the EM/Toupet fundoplication group (9.5 mm Hg) compared with the SM/Dor fundoplication group (15.8 mm Hg) (\(P = .007\)) (Table 3).

### 24-HOUR pH MONITORING

Postoperatively, the average proximal and distal esophageal acid exposure (SM/Toupet fundoplication group 5.0% vs EM/Toupet fundoplication group 6.0%) and the number of episodes were similar between the groups despite the different lengths of the myotomy. Six patients (32%) in the SM/Dor fundoplication group had abnormal DeMeester scores (>14.7); 13 patients (54%) in the EM/Toupet fundoplication group had abnormal DeMeester scores. There were no differences between the groups in acid exposure when the patients were in the upright or supine position (Table 3).

### RECURRENT DYSPHAGIA

Recurrent dysphagia was observed in 9 patients in the SM/Dor fundoplication group and in 2 patients in the EM/Toupet fundoplication group. Of those who underwent SM/Dor fundoplication, 5 patients required endoscopic therapy (a combination of 12 dilatations and 2 botulinum toxin injections). An additional 4 patients required reoperation for dysphagia to take down their fundoplication, extend the myotomy further on the gastric angle.
COMMENT

Our study shows, for the first time, that extending the myotomy well on the stomach (at least 3 cm) results in a more complete functional obliteration of the LES which in turn provides superior relief of dysphagia. Furthermore, this strategy seems to decrease the need for all forms of treatment for recurrent dysphagia in the medium to long-term follow-up. Lastly, we showed that when a Toupet fundoplication is added, the incidence and degree of postoperative gastroesophageal reflux are no greater than that observed with more traditional approaches despite a more substantial obliteration of the LES.

Minimally invasive techniques have been used in the treatment of achalasia for more than 10 years. As we reflect on the lessons learned during this decade, it is clear that, with the acceptance of this more effective form of therapy, the primary treatment of achalasia has shifted in many institutions from balloon dilation to surgery. As a consequence, a large number of patients have been treated, techniques have evolved, and the results of several large series have been published. This study addresses two ongoing areas of controversy: the length to which the myotomy should be extended below the GEJ and the most appropriate way to prevent (or minimize) postoperative gastroesophageal reflux.

LENGTH OF THE MYOTOMY BELOW THE GEJ

We reported the first series of patients treated with minimally invasive approach in the English literature in 1992.9 Our approach then, was via left-sided thoracoscopic since it provided excellent exposure of the distal esophagus, which at the time was our primary target for therapy. We patterned the original thoracoscopic technique after that described by Ellis et al, in which the lower esophagus and sphincter were divided with a limited (5-mm) myotomy of the stomach. The rationale for this short extension of the myotomy was based on the belief that most of the LES resided anatomically within the esophagus and that, by preserving the paraesophageal fibers of Willis at the GEJ, the incidence of gastroesophageal reflux postoperatively would be minimal. Thus, an antireflux procedure, which would then have been a major coup de force, was not needed. Several observations became clear with long-term follow-up. First, several patients (9 [26%] of 35 patients) returned with persistent or recurrent dysphagia. Second, a long myotomy in the stomach carried farther down with laparoscopic techniques (laparoscopic access to the hiatus had, by then, been popularized) yielded significant relief of dysphagia in these patients. Third, although few patients had any symptoms of gastroesophageal reflux, a significant number had abnormal levels of esophageal acid exposure when 24-hour pH testing was performed. Thus, it was clear that an antireflux procedure was needed.

As our experience with laparoscopic antireflux surgery and other esophageal procedures was increasing, it became clear that the laparoscopic approach could provide good visualization of the distal 6 to 10 cm of the esophagus, was less invasive than the thoracoscopic approach, and provided unrestricted access to the upper stomach. Thus, a myotomy of any length could be carried out and a fundoplication could be added to the procedure. We, as many others, began then to practice the Heller myotomy through the laparoscopic approach and extended the myotomy 1.5 cm (occasionally 2 cm) in the stomach.

Many studies have since shown that laparoscopic myotomy with this extension in the stomach provides excellent results, with improvement in dysphagia from 90% to 96%. However, as we followed up the first patients operated on with this strategy, we noted that had required additional procedures to treat recurrent dysphagia. Five of the 9 responded well to pneumatic dilatation. The effectiveness of postoperative pneumatic dilatation to treat recurrent dysphagia has been previously reported.10 More importantly, 4 (8%) of our 52 patients required a reoperation to treat recurrent dysphagia. At reoperation we performed a myotomy well in the stomach (about 3 cm below the GEJ) and, as we had previously observed with our patients who underwent thoracoscopic, dysphagia was once again relieved. These observations prompted us to change our approach. We began extending our myotomy another 1 to 1.5 cm in the stomach for a full 3-cm gastric myotomy.

As this study shows, the patients treated with the longer myotomy fared better. For example, the average postoperative LESP is below 10 mm Hg. A previous study has shown that, after balloon dilatation, patients whose LESP is below 10 mm Hg have less recurrence of dysphagia than those with higher LESP. The results of our study suggest that this is the case after surgical myotomy as well. We found that the average patient felt better in terms of dysphagia—significantly so—when compared with those with a shorter myotomy and, ultimately, the need for additional therapy lessened. Indeed, only 2 patients in the longer myotomy group had required dilatation (vs 5 patients in the SM/Dor fundoplication group). No patient in the EM/Toupet fundoplication group has needed a reoperation (vs 4 patients who underwent SM/Dor fundoplication).

ANTIREFLUX PROCEDURE

We were concerned as we conceived this longer myotomy that a more complete obliteration of the sphincter would lead to a more incompetent sphincter increasing the incidence and severity of postoperative gastroesophageal reflux. We had used no antireflux procedure initially when extending the myotomy only a few millimeters below the GEJ.9 When we changed our approach to the laparoscopic route and extended the myotomy fur-
ther on the stomach, we added a Dor fundoplication as described by Bonavina et al. The combination of extending the myotomy and adding an antireflux operation resulted in better relief of dysphagia and less gastroesophageal reflux. Thus, when we decided to perform an even more extended myotomy, it seemed only logical that we continue to use an antireflux procedure. As shown by the results in this study, the patients who underwent EM/Toupet fundoplication had a similar amount of abnormal gastroesophageal reflux as those who underwent SM/Dor fundoplication.

Some authors argue that an antireflux procedure is not needed. They argue that the incidence of gastroesophageal reflux disease can be kept low without an antireflux procedure by limiting mobilization and the extent of the myotomy. The rationale behind this recommendation relies on 3 arguments: first, an antireflux procedure will almost invariably lead to increased resistance through the GEJ, thus increasing the chance of dysphagia; second, the incidence of gastroesophageal reflux postoperatively is low; and third, current antireflux procedures do not necessarily result in normal acid exposure in all patients. The results of our study support the latter but leave unanswered the question of what might have happened to patients undergoing extended myotomy if an antireflux procedure was not added. Richards et al, a group that does not perform routine myotomy, argued that adding an antireflux procedure would increase the chance of recurrence of gastroesophageal reflux disease. However, the main differences, decreased LESP, improved dysphagia scores, and less need to treat recurrent dysphagia are all related to the myotomy itself rather than to the type of fundoplication. This is further supported by our observation that extending the myotomy in patients with postoperative dysphagia has almost always resulted in good restoration of swallowing. While we cannot dismiss the possible positive effect of a Toupet fundoplication on dysphagia, we doubt this is the case.

By contrast, other authors have recommended that a Nissen fundoplication be performed. Most surgeons agree that a total fundoplication (eg, Nissen) provides too much resistance and is likely to result in dysphagia. Most surgeons perform either an anterior (Dor) or posterior (Toupet) partial fundoplication. Proponents of the Dor fundoplication argue that the procedure is easier than a Toupet fundoplication and that the posterior esophageal attachments and the short gastric vessels may be left in place. In addition, the Dor fundoplication protects the exposed mucosa and helps seal potentially unidentified injuries. The Toupet fundoplication is thought to provide a more efficacious antireflux barrier and is commonly used in the treatment of primary gastroesophageal reflux disease. In addition, it may have an added benefit of keeping the edges of the myotomy separated. Some surgeons point out that a Toupet fundoplication may cause anterior angulation resulting in dysphagia. While this is theoretically possible, we have not experienced this problem.

Our study does not allow us to definitively conclude that a Toupet fundoplication is a better antireflux barrier. Clearly, neither approach (Toupet or Dor fundoplication) resulted in a completely competent cardia and normal acid exposure. The average acid exposure of the distal esophagus was, indeed, abnormal in both groups, and about one third of our patients had an abnormal DeMeester score despite the lack of symptoms. This fact underscores the importance for postoperative esophageal testing.

There are 2 limitations of our study. First, since each group was done during a different period, the follow-up is longer for the SM/Dor fundoplication group. It is, thus, possible that this may account for worse results in that group of patients. However, most failures of esophageal myotomy (dysphagia requiring treatment) are evident within the first 2 years postoperatively. In fact, of those patients in the SM/Dor fundoplication group who required reoperation, 3 of 4 were performed within 2 years of the original operation. Moreover, the patients in the EM/Toupet fundoplication group had, preoperatively, worse dysphagia scores than those in the SM/Dor fundoplication group. Therefore, while possible, it is unlikely that the fact that patients in the SM/Dor fundoplication group were followed up for a longer period can account for the differences we observed. The second limitation of our study is that we changed 2 variables (ie, the length of the myotomy and the type of fundoplication) instead of 1, making it more difficult to attribute just to the extension of the myotomy the improvement of the result. However, the main differences, decreased LESP, improved dysphagia scores, and less need to treat recurrent dysphagia are all related to the myotomy itself rather than to the type of fundoplication. This is further supported by our observation that extending the myotomy in patients with postoperative dysphagia has almost always resulted in good restoration of swallowing. While we cannot dismiss the possible positive effect of a Toupet fundoplication on dysphagia, we doubt this is the case.

Our experience confirms that laparoscopic myotomy is effective in the treatment of achalasia. Our study suggests that the length of myotomy, especially on the gastric side of the GEJ, is one of the most important aspects of the operation and that an EM/Toupet fundoplication is superior to the more traditional SM/Dor fundoplication. Indeed, the EM/Toupet fundoplication group had a more complete obliteration of the LES, as demonstrated by a more significant decrease in LESP; it resulted in better dysphagia scores and in fewer additional procedures to treat recurrent dysphagia. Lastly, our study shows that a Toupet fundoplication is safe, does not impair esophageal clearance, and provides a reasonable antireflux barrier after EM.

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DISCUSSION

Claude Deschamps, MD, Rochester, Minn: Dr Oelschlager and his colleagues are reporting on a series of 110 consecutive patients treated with laparoscopic myotomy and partial fundoplication. They compare 2 subgroups of patients operated on during 2 different, albeit consecutive periods. The first group of 52 patients had laparoscopic SM/Dor fundoplication. The second group of 58 had laparoscopic EM/Toupet fundoplication. They found that when the myotomy was extended more distally in the stomach and a partial Toupet fundoplication was added, the patients had less dysphagia, and less need for reoperation and endoscopic treatments postoperatively. The incidence of postoperative gastroesophageal reflux was similar in both groups. They conclude that an EM/Toupet fundoplication improves the dysphagia and provides a reasonable anti-reflux barrier.

Dr Pelligrini's team as usual has presented a large series of patients treated surgically for a rare disorder. They should be commended for their excellent results. This is a retrospective series but the number of patients is substantial considering the rarity of the disease. The 2 groups were different in their preoperative symptoms frequency and severity for dysphagia but that difference serve the authors well.

The worst group at the start got the most improvement postoperatively. The 1-year median follow-up in the second group is shorter by 30 months compared with the first group, but the authors correctly mention that most failures occur usually within the first 2 years after the operation. Seventy-five percent of the patients were available for follow-up and 40% had esophageal function tests postoperatively. The present analysis does not consider preoperative treatments such as botulinum toxin injections or pneumatic dilatations that can, in turn, affect perioperative complications, length of hospital stay, and functional results. This paper addresses 2 ongoing areas of controversy. The length of the myotomy and the best way to prevent or minimize postoperative reflux. As pointed out by the authors, their findings would have had more impact if they had modified only 1 variable at a time instead of 2.

Be that as it may, the current study provides new information and the authors deserve an A+ for showing reasonably well that a myotomy extended further on the stomach provides more relief of the obstruction and a better functional result. I am giving them a B− for concluding that a Toupet fundoplication is better than a Dor fundoplication. They might be right; and while I share the same bias, data to prove it are not here yet.

The authors should be praised for continuing to work so hard at improving the outcome of laparoscopic myotomy for patients suffering from achalasia. In their quest for better results, Dr Pelligrini's team has moved from thoracoscopy to laparoscopy and from high myotomy to lower myotomy. One can only hope they will not extend the myotomy to next sphincter . . . .

I have 3 questions. (1) The authors mention that the crura were never closed with a Toupet fundoplication. How were the crura treated when a Dor fundoplication was performed? (2) Did the authors looked into the possible effect of preoperative treatment(s) and the incidence of perioperative complications such as intraoperative perforations? (3) The authors say that gastroesophageal reflux is often silent as underscored by the results of postoperative pH monitoring studies. What is their recommendation for patients with no symptoms but with pathologic reflux on 24-hour pH monitoring?

Keith W. Millikan, MD, Chicago, Ill: I have been doing myotomies for about a decade and always done a 1-cm myotomy in the stomach and a Toupet fundoplication. My questions for the authors are technical ones. It is my belief that the Toupet fundoplication does not actually always function for the acid reflux part of the procedure but more when you are sewing the sides of the fundus and the greater curvature of the stomach to the sides of the myotomy that the Toupet actually holds the myotomy open at a time when scar tissue is forming. It is not the length on the stomach but rather the Toupet fundoplication that holds it open. Your emphasis was on the length on the stomach and the emphasis of the paper should be on the Toupet.

The second question, because I did not have the paper to read is, how do they determine that 3 cm length because laparoscopically as we have all done, you have a magnified view and what you thought originally might have been 1.5 to 2 cm may have been less and now what you are considering a 3-cm myotomy may actually be only a 2-cm myotomy because of the magnification of the laparoscope.

Philip E. Donahue, MD, Chicago: I congratulate Dr Oelschlager on an excellent presentation which began with a provocative hypothesis that myotomy extension will lead to better weakening of the LES. First, the anatomical perspective: While obstructing mechanisms in achalasia include LES and proximal gastric muscles, pressure is measured only in the LES. The question is: How do you make sure the sling fibers of Willis are divided? Do you use intraoperative manometry, endoscopy, or do you just sort of look at it anatomically? Is it possible that your...
clinical results reflect more accurate division of these gastric sling fibers of Willis in your more recent patients?

How is it possible that dividing gastric muscles would change LESP? It’s impossible. Lower esophageal sphincter pressure is affected by the LES muscle. I am looking forward to your answer to that one.

My last question is for Dr Pellegrini: When you have reported your results of operation in the past, the results have always been good—(93%-95% good to excellent). Yet, you changed your approach, adding an extra centimeter to the myotomy; I am curious about why you changed when the results were already good.

Claude H. Organ, Jr, MD, Oakland, Calif: I take it, Dr Donahue, that you do not use the “hell of a long” Heller myotomy.

Dr Donahue: In response to Dr Organ’s question, I do favor gastric myotomy extending 2.0 cm on the stomach, as we have published recently in Surgery (November 2002).

Marco G. Patti, MD, San Francisco, Calif: I also want to congratulate Dr Oelschlager for his excellent presentation and for allowing me to read the paper before the meeting. Overall, I agree with 3 points his group made (1) the operation should be performed through a laparoscopic approach; (2) the myotomy must be extended on the gastric wall for more than 5 mm; and (3) a partial fundoplication must be added to the myotomy to prevent reflux.

I have some comments and questions about this retrospective study. The authors compared 2 groups: 1 operated on between 1994 and 1998 and 1 operated between 1998 and 2001. It seems that not one but 2 variables have changed between these 2 groups, specifically the length of the myotomy and the type of fundoplication. I was surprised that you gave all of the credit for the better results in this second period to the more extended myotomy on the gastric wall. I would argue instead that in the first period you might have problems with the laparoscopic myotomy and the Dor fundoplication, reflecting a learning curve for a technique that was not used frequently before. For instance, in San Francisco we had the same problems between 1993 and 1996 until we learned how to do both a good myotomy and a good Dor fundoplication.

My questions are the following: Can you describe the technique you used for the Dor fundoplication? Specifically, did you use 4 or 2 rows of sutures? What were the findings in the 4 patients who needed a second operation for dysphagia and the SM/Dor fundoplication group? How did you measure the length of the myotomy, 15 vs 30 mm? Did you perform intraoperative endoscopy in every patient? Considering the high incidence of reflux (32% after Dor fundoplication and 54% after Toupet fundoplication), how do you plan to treat and follow-up these patients to detect in the future the development of reflux? Did you assess the treatment of reflux? Could you give us a little more information on how many of these patients are using proton pump inhibitors or histamine, antagonists? Did you also perform upper endoscopy in these 40% of patients who came back later to objectively assess for presence of esophagitis? Lastly, while you assessed esophageal manometry postoperatively and you showed us data for LESp, did you look at esophageal emptying specifically? Do you have a way to assess how this diseased esophagus empties with liquids vs solids?

Raymond J. Joehl, MD, Chicago: I enjoyed your paper, Dr Oelschlager and Dr Pellegrini; you are to be congratulated for continuing to contribute to the surgical experience with this rare disease. At Northwestern University we use operative manometry to guide us in how long we make this myotomy and that in some patients it should be 3 cm and in some patients it is 1 cm. You are to be congratulated to get 40% of your patients to return for pH monitoring and manometry. This is a difficult test to recruit patients to do who are relatively asymptomatic. Did you assess the treatment of reflux? Could you give us a little more information on how many of these patients are using proton pump inhibitors or histamine, antagonists? Did you also perform upper endoscopy in these 40% of patients who came back later to objectively assess for presence of esophagitis? Lastly, while you assessed esophageal manometry postoperatively and you showed us data for LESp, did you look at esophageal emptying specifically? Do you have a way to assess how this diseased esophagus empties with liquids vs solids?

Jay L. Grosfeld, MD, Indianapolis, Ind: Thank you, President Organ. Carlos, I enjoyed the presentation by your young associate. Operative treatment of achalasia has been a controversial issue over the years. It is important to recognize that operative therapy for this condition is to relieve symptoms. It does not cure the disease. The disease is a lifelong disease. The esophagus will never be normal because of its intrinsic autonomic impairment of motility. Achalasia also occurs in children and, if you follow their postoperative course out 20 or 30 years, some of the children will require an esophagectomy later in life because over the long term (even with partial wraps) esophagitis and Barrett esophagus can occur. The motor function of the abnormal esophagus may get worse over time; in some instances, some of the patients require an esophagectomy. I am not referring to those who require esophagectomy for malignancy because of the increased risk of cancer in patients with achalasia, but those with very poor esophageal function.

Could you give us some indication how you would anticipate this operation using a Toupet partial wrap and gastric extension of the myotomy (with a short follow-up) will impact the long-term outcome of these patients and how many of your patients from the University of Washington with achalasia have eventually required esophageal resection.

Dr Pellegrini: Dr Deschamps thank you for your compliments. In respond to your first question, we do not close the crura in patients operated on for achalasia, whether we add a Dor or a Toupet fundoplication, as we do not wish to create new barriers that might impair esophageal emptying. You asked about the kind of treatment that these patients had undergone before our operation. Among the 52 patients who underwent SM/Dor fundoplication, 16 had had botulinum toxin injections and 8 had had botulinum toxin injections and dilatations before our operation. Among those in the EM/Toupet fundoplication group, 12 had had botulinum toxin injections and 3 had had botulinum toxin injections and dilatations. Thus, the use of other therapeutic modalities before our initial operation was similar in both groups. Lastly, we recommend proton pump inhibitors for patients who have silent reflux.

Dr Millikan pointed out an additional positive effect of the Toupet fundoplication. It may well be possible that the patients in the EM/Toupet fundoplication group did better precisely because the gastric flaps are holding the myotomy open. It is, indeed, impressive to see how much lateral displacement on the edges of the myotomy results from suturing the gastric flaps to them. Of course, a Dor fundoplication does exactly the opposite. You, Dr Patti, and Dr Vanderpool asked how we measure the 3 cm. This is an important technical point and I believe a crucial aspect of the operation. We dissect the anterior vagus nerve off the anterior wall of the esophagus so that it can
be displaced to the patient's right. Then, using a lighted 52F bougie through the GEJ, we dissect and resect the fat pad that covers the GEJ and the adventitia of the distal esophagus. This is the only way in which the surgeon can expose and identify precisely where the external GEJ lies. Then, we determine, using an instrument that opens 3 cm which is the point in the stomach, at which the myotomy should start and proceed upward to the GEJ.

Dr Donahue correctly pointed out that the sling fibers of Willis have something to do with the emptying of the esophagus and may preclude its emptying in patients with achalasia. The reason why this more extensive myotomy works better, is precisely because we divide those sling fibers. Now are those sling fibers, in answer to your second question, Phil, a component of LESP? I do not know, but I can tell you that when one examines the GEJ endoscopically during an operation one is struck by the fact that the esophageal obstruction caused by achalasia is always more distal than the external GEJ. The answer to your last question is a bit more complex. What made us change in 1994 from a standard esophageal myotomy to a longer one? As we looked at the first series of patients, those who had had thoracoscopic myotomy at a time when we carried out the myotomy only just passed the GEJ, we realized that, by 5 years we had had to reoperate on about 25% of them for recurring dysphagia. As we looked at the series of patients treated with the standard myotomy, we realized that 9% had had to be reoperated. In both groups there was something in common: at reoperation, a much longer myotomy, solved the problem. We decided to try and see if a routine use of a longer myotomy would prevent reoperation. At the same time, we knew that with the Dor fundoplication we experienced a gastroesophageal reflux rate of about 25% and sought another type of reconstruction with the hopes of improving esophageal acid exposure. Although our reflux rate continues to be high, we found that the Toupet fundoplication helped us keep the myotomy edges wide apart.

Dr Patti asked us, could it be that we did not know how to do the Dor fundoplication? I doubt that that is the case, but I am willing to concede on that point. To do a Dor well is a lot more difficult conceptually than to do a Toupet. I can teach anybody how to do a Toupet fundoplication. It is clear; it is easy. You asked how many rows of sutures we place in the Dor fundoplication: we place 4. The first row over the left crus, then a second row over the left side of the myotomy, a third row on the right side of the myotomy, and then we put a fourth row on the right crus. So I am not trying to say that the Dor fundoplication does not work. I am trying to say in our hands and with an extended myotomy, the Toupet fundoplication seemed to work at least as well as the Dor. You asked about the findings in the 4 patients who needed a second operation. In 3 of those patients, we had the impression that the right most suture line of the Dor, that is, on the right crus, was pulling the right crus over the esophagus and that by releasing that and removing the Dor fundoplication we were relieving an obstruction. In those patients, we also did another myotomy, so whether it was the take down of the Dor or the extension of the myotomy that provided the relief of dysphagia in those individuals is impossible to say. Of the 4, 3 underwent a Toupet fundoplication; the 1 just simply had the Dor taken down and nothing else was done. We already described how we measured the myotomy length. We performed intraoperative endoscopy routinely before we extended our myotomy. We now perform it selectively. As pointed out before, we treat patients found to have silent reflux with proton pump inhibitors. I am not sure that everybody needs to be treated but we start therapy with proton pump inhibitors. I am not sure about a more classic classification of swallowing status. I think we have given you the data as the patients gave it in answer to our questionnaires. As you know, talking about “excellent” vs “good” results is harder. As Dr Grosfeld pointed out after your discussion, this is a disease that goes on for life, so patients change their habits, change the way they eat, and sometimes this is not even conscious. We prefer to just let them complete a questionnaire every time we see them, answering, to the best of their ability, how they are doing.

Drs Vanderpool and Grosfeld referred to the issue of emptying. These patients, if you measure them objectively, do not seem to improve that much in the emptying and, yet, symptomatically they seem to have a significant improvement. We have experienced only a few perforations, all recognized and treated with a single 5-0 silk suture at the time of operation. We have had no leaks in this series of 110 patients. With regards to the sigmoid esophagus, we offer these patients a myotomy, we do a higher dissection of the esophagus and try to bring it down as much as possible. In some patients we have had to sew the esophagus to the crura and have not done a fundoplication (not included in this series). The results have been pretty much the same as in patients without the sigmoid deformity. I believe I have addressed your other questions in response to other discussants.

Dr Grosfeld, we appreciate your comments and agree with you that patients must be counseled to the effect that this disease is for life. We have not had to do an esophagectomy among any of the patients reported on today but we have done esophagectomies in patients treated before 1994. We have also done esophagectomies in patients referred to us who have undergone previous myotomy.