Outcomes and Health-Related Quality of Life After Esophagectomy for High-Grade Dysplasia and Intramucosal Cancer

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Hypothesis: The reported morbidity and mortality associated with esophagectomy for high-grade dysplasia (HGD) and intramucosal cancer (IMC) have led asymptomatic patients to consider less invasive and possibly less effective treatments. This study provides a critical assessment of outcomes and health-related quality of life (HRQL) after esophagectomy for HGD and IMC.

Design: Cohort analytic study.

Setting: Section of thoracic surgery at a tertiary referral center.

Patients: All patients who presented between May 1991 and February 2003 with a biopsy-proven diagnosis of Barrett esophagus with HGD or IMC were assessed.

Main Outcome Measures: Prospective analysis of postoperative morbidity, mortality, HRQL, and gastrointestinal symptoms.

Results: Follow-up was complete in 36 patients. Mean follow-up was 4.9 years (range, 0.5-12.0 years). The incidence of postoperative invasive cancer was 39%, with stages ranging from I to IIB. There were 4 major complications (11%) and no operative mortality. Twenty-eight patients were alive, with a cancer-free survival of 85%. The HRQL outcomes (Medical Outcomes Study 36-Item Short-Form Health Survey) were comparable with those of age- and sex-matched controls. Significant differences in post-esophagectomy gastrointestinal symptoms were seen with a decreased incidence of heartburn \( P \leq 0.001 \) and increased requirement for a slower speed of eating. Twenty-two (79%) of the 28 patients described their current eating pattern as “normal or insignificantly impacted.”

Conclusions: Esophagectomy for HGD and IMC can be accomplished with low morbidity and mortality. Furthermore, most patients are able to resume a normal eating pattern, and postoperative HRQL can be equivalent to that of the general population.

Arch Surg. 2006;141:545-551

The American College of Gastroenterology defines Barrett esophagus (BE) as “a change in the esophageal epithelium of any length that can be recognized at endoscopy and is confirmed to have intestinal metaplasia by biopsy.” Patients who harbor BE increase their risk of esophageal adenocarcinoma 30 to 125 times that of the general population. The risk of malignant degeneration is significantly increased when BE is associated with high-grade dysplasia (HGD). Although a variety of treatment modalities are being evaluated in the treatment of BE with HGD, suitable patients have historically undergone esophagectomy because of the incidence of undiscovered invasive esophageal adenocarcinoma (15%-73%) and the high expectation of a surgical cure. Heitmiller et al demonstrated a significant risk of occult invasive cancer in a reported cohort of 30 esophageal resections with preoperative pathologic findings of BE with HGD but postoperative pathologic findings revealing invasive cancer in 43%, with 5 (17%) of these being stage II or III cancer. Additionally, the pathologic distinction between HGD and intramucosal cancer (IMC) is difficult and subject to wide interobserver variation.

A simple perusal of the literature demonstrates significant potential for morbidity (30%-40%) and mortality (3%-10%) after esophageal resection. This has resulted in some physicians and patients pursuing less invasive treatments, including periodic endoscopic surveillance with biopsy, endoscopic mucosal ablation therapy with either photodynamic therapy (PDT) or thermal cautery devices (ie, argon plasma coagulation or laser ablation [Nd:YAG or KTP:YAG]), or endoscopic...
mucosal resection (EMR). These therapies are appropriate alternatives in poor surgical candidates, but in healthy patients questions remain regarding their long-term effectiveness and posttreatment sequelae. Our experience has suggested that esophageal resection need not be a highly morbid procedure with a poor functional outcome. The purpose of this review was to assess the morbidity, mortality, long-term survival, and health-related quality of life (HRQL) associated with esophagectomy for HGD and IMC at a high-volume esophagectomy center. This review will provide a more current standard against which the nonresectional therapies for HGD and IMC can be compared.

METHODS

All patients who presented to Virginia Mason Medical Center between May 1991 and February 2003 with a biopsy-proven diagnosis of BE with HGD or IMC were assessed by gastroenterologists and thoracic surgeons and, when appropriate, medical and radiation oncologists. Patients who were considered to be surgical candidates were prospectively entered into an institutional review board–approved database, which included demographic and clinical information and perioperative mortality, morbidity, and postoperative symptoms. The esophagectomy database and current study were approved through the Virginia Mason Medical Center institutional review board. All patients underwent preoperative staging, including computed tomography and endoscopic evaluation. Endoscopic ultrasound was introduced to our medical center in 1996 and was used in 27 patients. Patients with invasive cancer on postoperative pathologic reports were included in this series. Each patient was contacted by mail, consented to participate in the study, and subsequently completed postoperative self-administered surveys to assess current gastrointestinal-specific symptoms and HRQL parameters.

Postoperative HRQL was measured using the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), a well-described HRQL questionnaire that has been extensively studied and validated in many disease models for assessing quality of life in 8 domains. These parameters were compared with norm-based values from the general population and age- and sex-matched controls. The mean score for the 1998 US general population is set at 50 in all domains and component summaries. Specific norm-based values vary with sex and age older and younger than the general mean of 50 years. Thus, individuals in our study were compared with their age- and sex-matched controls to account for this variance. Statistical analysis was performed using the $\chi^2$ and $t$ tests when appropriate, with a statistical software package (StatView; SAS Institute Inc, Cary, NC).

RESULTS

PATIENTS

Thirty-six patients with a preoperative diagnosis of BE with HGD or IMC were identified. Pathologic status was verified by at least 2 independent pathologists at separate institutions. Most patients were male (92%), and the mean age was 66 years (range, 43-88 years). The most common presenting symptoms were gastrointestinal reflux symptoms in 32 patients (89%), with 6 patients (17%) having prior antireflux procedures and 28 patients (77%) using antisecretory medications. A history of tobacco use and alcohol use was reported in 75% and 78% of patients, respectively. All patients had an American Society of Anesthesiology score of either II (64%) or III (36%). Preoperative comorbidities are listed in Table 1.

OPERATIVE RESULTS

Esophagectomies were performed using a left thoracoabdominal (60%), transhiatal (20%), or Ivor-Lewis (20%) approach. The stomach was used as a conduit in all patients with the anastomosis in the chest (20%) and neck (80%). A pyloroplasty was performed in only 1 patient (3%) owing to a stenotic pylorus, as assessed at the time of surgery. Feeding jejunostomies were used in 75% of the patients. The mean operative time was 6.7 hours (range, 5.2-10.1 hours). The mean blood loss was 297 mL (range, 150-600 mL), and no patient required a blood transfusion. Six concomitant procedures were performed: cholecystectomy (2), pulmonary wedge resection (2), liver biopsy (1), and thoracic duct ligation (1). The mean intensive care unit and hospital length of stay were 2 days (range, 1-7 days) and 10 days (range, 7-18 days), respectively. There were 16 minor complications (Table 2). Major complications included 2 cervical anastomotic leaks, which did not require additional operation, and 2 chyle leaks, one requiring computed tomography–guided drainage and the other responding to nonoperative therapy. No patient required any further surgical interventions. The minor and major complication rates were 44% and 11%, with an in-hospital and 30-day mortality of zero (Table 2).

PATHOLOGIC FINDINGS

Preoperative biopsy specimens demonstrated BE with HGD (64%) or IMC (36%). Preoperatively, 11 patients had HGD and 11 had stage 0 (Tis N0 M0), 12 had stage I (T1 N0 M0), and 2 had stage II (T1-2 N0 M0) disease. Invasive adenocarcinoma was identified on postoperative pathologic specimens in patients with HGD (6/23; 26%) and IMC (8/13; 61%). Overall postoperative incidence of invasive cancer was 39%, with stages ranging from 1 to IIB.
Follow-up was complete in all patients. The mean and median follow-up time was 4.9 years and 4.0 years (range, 0.5-12.0 years), respectively. Twenty-eight patients were alive at follow-up. Five patient deaths were due to cardiac causes, 2 were esophageal cancer related, and 1 was from an unknown cause. The 5 cardiac deaths occurred between 2 and 11 years after surgery (mean, 5.8 years), whereas 2 esophageal cancer deaths occurred at 1 and 4 years with stage IIB and I disease, respectively. Preoperative and postoperative symptoms and assessment of ability to eat are reported in Table 3. Twenty-two patients (79%) reported “normal or insignificantly impacted eating.” The most commonly reported symptom was the requirement for a slower speed of eating (93%). In addition, preoperative body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters) was classified as ideal (BMI, 18.5–24.9) in 7%, overweight (BMI, 25.0–29.9) in 64%, and obese (BMI, >30) in 29% (Table 4). At the time of follow-up, a significant reduction occurred in the mean BMI of 28.9 to 25.6 (P = .003). However, no patient was classified as underweight at the time of follow-up. Postoperative SF-36 questionnaires were completed by the 28 patients alive at follow-up. The postesophagectomy population equaled or exceeded HRQL scores in 7 of 8 domains compared with age- and sex-matched norm-based values from the 1998 US general population (Table 5).

**Follow-up**

The natural history of BE with HGD and its potential to evolve into invasive cancer is an area of intense interest. Reid et al followed up 322 patients with BE, 75 of these with HGD, by surveillance and biopsy during a 15-year period and found that 59% of the patients with HGD developed adenocarcinoma during the first 5 years. Despite this and other evidence linking progression from HGD to invasive cancer, the perceived high morbidity after esophagectomy has encouraged some to consider less invasive strategies. Periodic endoscopic surveillance every 4 to 6 months has been proposed as an alternative to esophagectomy. This approach entails a frequent rigorous assessment that involves systematic 4-quadrant biopsy specimens every 2 cm.21 However, the inconvenience of a long-term commitment to frequent endoscopies with multiple biopsy specimens and the complexity of pathologic interpretation has limited its practicality. A potential emotional toll is also associated with continuing to live with a condition that has a high propensity for the development of cancer.

Mucosal ablative therapies for BE with HGD can potentially use bipolar electrocautery, argon beam or laser technology (Nd:YAG, KTP:YAG), and more commonly PDT to “eradicate” the HGD and potentially the entire BE segment.14-16 Although the ablative techniques are
Series in the literature. Fourteen patients were found to harbor invasive adenocarcinoma in the final pathologic specimens despite a rigorous prescreening approach using computed tomography, endoscopic ultrasound, and endoscopy. This is consistent with a 17% to 30% of patients, including significant bleeding, motility disorders, stricture, and perforation. Most importantly, Krishnadath et al found an overall complication rate of 57% and 30%, rates much higher than historical reports of esophageal resection, significantly higher than the Mayo Clinic (not reported at Johns Hopkins University), and a 30-day mortality of 1.8% and 3.3%, respectively. These results are consistent with our findings of an overall 44% complication rate, a 5.5% anastomotic leak rate, and zero 30-day mortality, and they confirm the ability to perform these operations with acceptable morbidity and very low mortality (Table 2). These reports have originated in centers that, similar to our approach, routinely use perioperative thoracic epidural anesthesia and analgesia. Patient-controlled epidural analgesia demonstrably attenuates the physiologic perturbations after surgery by reducing the stress response, improving postoperative pulmonary function, and providing better analgesia, all of which result in fewer complications. In addition, we have previously demonstrated that minimizing intraoperative blood loss and postoperative transfusion requirements can affect postoperative outcomes.

Appropriate assessment of treatment outcomes depends not only on restoration of gastrointestinal continuity and minimizing morbidity and mortality but also on evaluating the treatment effect on each patient’s gastrointestinal symptoms and HRQL. This is particularly important in this population because of the high expectation that these patients will be cured of their BE and early cancer and therefore will have a high likelihood of living out the rest of their lives. In the current series, SF-36 scores equaled or exceeded the age- and sex-matched general population in 7 of 8 domains. In particular, the physical component summary and bodily pain scores equaled or exceeded the age- and sex-matched general population values. This is particularly important in this population because of the high expectation that these patients will be cured of their BE and early cancer and therefore will have a high likelihood of living out the rest of their lives. 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style and eating pattern. Each patient completed a self-administered questionnaire regarding past and current symptoms. Nonsignificant trends toward an increase in stool frequency, regurgitation, and dysphagia and a significant reduction in heartburn (77% vs 18%; P < .001) were identified. Most patients recognized the need for a slower speed of eating (11% vs 93%; P < .001) after esophagectomy, but few thought this issue to be clinically, nutritionally, or socially significant. Notably, 79% of patients reported “normal or insignificantly impacted eating” (Table 4). These findings are consistent with our previous prospective evaluation of postesophagectomy dietary status, in which 85% of patients reported normal or minimally limited dietary intake. An indirect measure of gastrointestinal function and dietary intake is an individual’s BMI. As previously stated, only 7% of patients were preoperatively classified as being at an ideal weight, with all others being overweight or obese (Table 4). Although there was a significant reduction in BMI after esophagectomy (28.9 vs 25.6; P < .001), the mean postoperative BMI remained in the overweight category. In addition, no patient was postoperatively underweight (BMI < 18.5), with 42% falling into the ideal weight range postoperatively. Of note, most patients reported their weight loss within the first year after surgery. Most patients after esophagectomy for HGD and IMC are able to eat normally and provide adequate caloric intake to maintain a stable body weight.

In this study we demonstrated that esophageal resection performed at a high-volume center for HGD and IMC can be achieved with minimal morbidity and a very low operative mortality. In addition, postoperative symptoms are minimal and generally well tolerated, as expressed by the facts that 79% of patients reported eating normally and HRQL was comparable with that of age- and sex-matched controls from the general population. We believe that esophageal resection should remain the standard approach in healthy patients with HGD and IMC and that these operations are preferably performed in experienced high-volume hospitals.

Accepted for Publication: January 2, 2006.

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Previous Presentation: This paper was presented at the 113th Scientific Session of the Western Surgical Association; November 7, 2005; Rancho Mirage, Calif; and is published after peer review and revision. The discussions that follow this article are based on the originally submitted manuscript and not the revised manuscript.

REFERENCES


DISCUSSION

Raymond J. Joehl, MD, Maywood, Ill: The authors reviewed an experience with esophagectomy for HGD and IMC to assess results and outcomes. They prospectively assessed morbidity and mortality, postoperative symptoms, and quality of

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life in 36 patients. There were no deaths within 30 days after esophagectomy, indeed an excellent result.

I have the following comments and questions. A colleague of mine, Dr Steve Sontag at Hines VA hospital, actively follows scores of veterans with BE on a protocol he calls “the hunt.” “The hunt” involves regular and frequent upper endoscopy and biopsies. Dr Sontag has reported that few patients progress to invasive carcinoma, and thus a small number of patients are candidates for esophagectomy. Dr Sontag’s average veteran patient has more comorbid illnesses and poorer functional status than the cohort of patients reported here. Do the authors think that good results reported by gastroenterologists like Dr Sontag are merely due to the Hawthorne effect?

Of the 36 patients in this report, 92% were men. Is this disease known to be gender specific? How many of the authors’ patients were in a program of active or frequent surveillance of dysplastic BE prior to surgery?

Six of the patients had previous antireflux procedures. Had fundoplications dehisced and hiatal hernias recurred in these patients? Were there any patients who had significant comorbid illnesses and deemed to be unacceptable surgical candidates who you excluded? If so, what criteria did the authors use to recommend no operation?

Some of the so-called minor postoperative complications appeared to be major, for example, partial small-bowel obstruction, pneumonia, and pneumothorax. What criteria were used to differentiate major from minor complications? The authors performed 3 different procedures—most commonly, left thoracoabdominal approach, and less commonly, transthiatal and Ivor-Lewis procedure. How were patients selected for these different procedures?

I am intrigued that only 1 of your patients had pyloroplasty, as reported in the manuscript, and this was done for ste- notic pylorus, in conjunction with gastric mobilization and esophageal replacement, and nearly all patients (93%) reported a “slower speed of eating” yet appeared to have maintained body weight postoperatively. Was there an advantage in your patients who had an intact pylorus and early satiety to help maintain postoperative body weight?

Please comment on significantly improved “bodily pain” perception after esophagectomy. Is it due to remarkably improved heartburn and GERD [gastroesophageal reflux disease] symptoms? Please comment also on the possibility that pyloroplasty, which many surgeons perform in conjunction with esophagectomy, may be associated with dumping syndrome and a poorer outcome.

The authors reported a significant fraction of patients who were obese and who had other disease risk factors. To identify patients at risk sooner, in the absence of reliable molecular and biological markers, do the authors now recommend endoscopic screening and biopsy in obese smokers with hiatal hernia and GERD symptoms and who drink excessively? Please comment on these apparent risk factors for BE dysplasia.

Dr Low: Thank you, Dr Joehl. With respect to the place of endoscopic surveillance and Dr Sontag, I think it is very important to differentiate between surveillance in people with standard BE and surveillance in people with HGD.

The BE follow-up group in Seattle has published on a group of 322 patients with BE who they followed up for almost 15 years. Seventy-five of these patients had HGD, and 39% of them developed cancer within 5 years. In addition, we have multiple publications of surgical series that indicate that the incidence of invasive cancer in patients who are felt to have HGD is as high as 30% and 79% prior to resection.

I think that responsible follow-up in subgroups of patients even with HGD is appropriate. The only thing that I would encourage Dr Sontag to do is that if he is following up people with HGD, these patients, at some point, if they are good surgical candidates, should sit down with an experienced esophageal surgeon to be made aware of their options for dealing with this problem definitively. They should also be aware of the risk of developing cancer over the long term. The important issue for these patients long term is to develop the genetic markers that will enable us to identify the people who are at particular risk for the development of invasive cancer.

With respect to male predominance, this was certainly marked in this group but is less marked in our overall esophageal cancer database. I don’t think at this point we can use gender as an important factor in either screening or treatment. As to how many patients in this particular resectional series were in surveillance programs: over 50% at the time they presented to the surgical service.

With respect to the previous antireflux procedures, there were a variety of residual repairs left at the time of resection. However, I think the most important point to be taken away from this is that even on maximal PPI [proton pump inhibitor] therapy or after an antireflux procedure, whether it is successful or not, people with BE still require long-term endoscopic follow-up, because even people with successful antireflux surgery can go on to develop high-grade dysplasia and cancer.

With respect to comorbid illness and how we selected our patients to undergo esophageal resection, all people who come to our institution are assessed by the surgical service and see one of our interventional gastroenterologists. All patients are also prescreened at a multidisciplinary tumor conference. I believe that under those circumstances we get the best opportunity to allocate them to appropriate levels of therapy. I don’t think that comorbidity should necessarily preclude esophageal resection, especially when you adapt the operative approach according to the patient’s physiologic and pathologic characteristics. With respect to the reporting of minor or major complications, we used a framework that has been commonly used when reporting esophageal resectional outcomes.

As to the reason why we did various types of surgical approaches, I believe in this day and age that we as esophageal surgeons should be offering our patients a variety of esophageal resectional approaches. Too often surgical publications have centered on “Here are my results with one approach, this is the best approach, and it is the best approach because these are my results.” Overall, we should be adapting our approach to the individual patient physiology, comorbidities, and body habitus.

The reason that there are a limited number of transthiatal resections in this group is that I stopped doing them when I recognized that a significant component of this group is going to have invasive cancer and therefore warrants a thoracic lymph node dissection. I believe the left thoracoabdominal is poorly understood generally in this country but is an outstanding operation that allows placement of the anastomosis in the neck, as well as a complete lymph node dissection. The Ivor-Lewis procedure is an excellent alternative when location of the BE segment allows an anastomosis high in the chest. The Ivor-Lewis procedure is also preferable in patients with significant cardiac comorbidities, because the interoperative manipulation of the heart is minimal.

With respect to the gastric emptying procedure, we have previously found that a well-positioned verticalized conduit will empty appropriately and negates the necessity of a pyloroplasty or a pyloromyotomy and decreases the incidence of dumping postoperatively. With respect to the actual recommendations for screening patients for BE, the AGA [American Gastroenterological Association] is currently reviewing this particular issue. To my knowledge, there is no currently recommended formula for identifying patients who should be screened for BE in the US population. However, if you are asking my personal opinion, especially in people under 50 years old, if we are going to relegate these people to long-term PPI utiliza-
tion and they come in with chronic reflux disease, I believe these people should be put on PPIs and then undergo a standard screening endoscopy. I believe this will do 2 things: (1) it will ensure that any esophagitis is controlled by their current PPI, and (2) it will give a baseline impression as to whether these people have BE and should be followed up in the long term.

Vic Velanovich, MD, Detroit, Mich: I have a question about why you chose the SF-36 as your quality-of-life outcome measure, being a generic instrument, and not going to more disease-specific instruments. It may not have the responsiveness you are looking for with regard to the gastrointestinal symptoms that you presented here. I wonder if you could help clarify that.

Dr Low: I think in general terms we chose the SF-36 because it is at the present time the most widely recognized and the most widely accepted quality-of-life score that we have. You are quite right, there are other alternatives such as the GQoL [Gastrointestinal Quality of Life Index] score, which looks more specifically at gastrointestinal symptoms. At this particular time not only is the SF-36 generally recognized and understood, but it provides the opportunity of comparing both age- and sex-matched controls, which we thought was a particularly important aspect for a postoperative comparison in this population.

Tom R. DeMeester, MD, Los Angeles, Calif: Dr Low, I appreciated the emphasis of your paper. It is a message that needs to get into the surgical literature; that is, patients with early abnormalities of the esophageal mucosa such as HGD or IMC can undergo esophagectomy with low morbidity and low mortality. However, patients still desire to avoid an operation if possible for such early lesions. Of the various other options you listed, the most competitive option is endoscopic mucosal resection. Do you think that is an option in these very early lesions, and if so, should surgeons get involved in such a procedure?

I would also like to encourage a second thought. We have also struggled to lower the morbidity and mortality of esophagectomy and have taken a suggestion from Akiyama’s publication [Akiyama H, Tsurumaru M, Ono Y, Udagawa H, Kajiyama Y. Esophagectomy without thoracotomy with vagal preservation. J Am Coll Surg. 1999;178:83-85] and started using the vagal-sparing esophagectomy for patients with no visible lesion but a biopsy that shows HGD or IMC. The advantage of the approach is that you do not enter the chest. You basically strip the esophagus out like pulling your sock inside out. A proximal gastric vagotomy is done, allowing tubing of the greater curvature and resection of the proximal stomach. The left gastric artery remains intact and provides great blood supply to the gastric tube and avoids the Anastomotic problems due to ischemia of the cephalad end of the tube. Minimal thoracic intervention, preserving vagal nerve function and maintaining gastric blood supply, results in a procedure with a very low morbidity and unlikely mortality. This makes esophagectomy for early disease a less morbid procedure. Have you tried such an approach?

Dr Low: You actually brought up 2 points that I am delighted to be given the opportunity to comment on. First, endoscopic mucosal resection. To answer your question whether surgeons should be involved, absolutely. I believe that, as the Japanese are starting to suggest, we are going to be able to resect long segments of esophageal mucosa effectively, and surgeons should be in the forefront of this effort. I also believe that esophageal mucosal resection is the preeminent endoscopic approach for definitive treatment in certain patients, especially with short-segment HGD. If we can reproducibly completely resect the HGD area, then that, to me, is adequate endoscopic management. The interesting thing we are finding at our institution is that endoscopic mucosal resection is in fact upstaging a significant component of these patients. When invasive cancers are found with endoscopic mucosal resection, appropriate surgical candidates should undergo resection.

With respect to your comments regarding vagal-sparing esophagectomy, I think that it is an additional example of a concept we have already discussed. Esophageal surgeons should have a wide variety of approaches to managing these problems. The vagal-sparing esophagectomy is a potentially important addition to our armamentarium. I think laparoscopic or thoracoscopic esophagectomy will also play a role in these particular patients. Most important, we should not have just one approach to any situation; we should be adapting the approach to the individual patient presentation.

Mark Talamonti, MD, Chicago, Ill: I enjoyed this paper very much, and I think the conclusions are significant because this is a decision that we frequently have to discuss with the patients after they have already been given advice by the gastroenterologists in terms of what their best treatment should be. I am curious about how you followed up the patients after esophagectomy. In your review of quality of life and symptoms, you mention that dysphagia was significantly reduced, but we have also seen, and we favor, transhiatal esophagectomy in the institution I am at for this patient population: patients with symptomatic bile reflux after that operation, whether the anastomosis is put in the chest or high in the neck. One of the rationales you had for a surgical approach vs a nonsurgical approach was to minimize the amount of surveillance endoscopy patients subsequently have to undergo. However, it has been our practice to still subject these patients, perhaps less frequently, to surveillance endoscopy to monitor for reflux or recurrent BE in the esophageal remnant. I would like your comments on that.

Dr Low: Thank you for the opportunity of addressing 2 other very important issues. The first point is the bile reflux issue. We have mentioned that we do not routinely use a gastric emptying procedure (ie, pyloromyotomy or pyloroplasty). One of the reasons that we do not in these particular individuals is we think it decreases bile reflux and also decreases the overall incidence of dumping. The other issue, which is equally important, that you brought up is the surveillance of people after surgery. First, I will say that far too often I get to see people after esophageal resections elsewhere who have not had the entire BE segment removed. We as esophageal surgeons have a primary responsibility for resecting all BEs at the time of the primary procedure. If we cannot do that, then the follow-up obviously changes.

With respect to people who have negative margins for BE at the time of primary surgery, we routinely recommend endoscopy at 1 year and 2 years following surgery, and then if those patients are clear, we do not routinely follow them up in the long term. Whether this is right or not I am not sure, but that is our process at the present time.