# An Assessment of the Optimal Time for Removal of Esophageal Stents Used in the Treatment of an Esophageal Anastomotic Leak or Perforation

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*Background.* **Esophageal stent for the treatment of a perforation or anastomotic leak has been shown to be effective and safe. However, the optimal timing for stent removal is in question. This purpose of this investigation was to identify a time for stent removal in patients treated for an acute perforation or anastomotic leak that resulted in sealing of the leak while minimizing the incidence of stent-related complications.**

*Methods.* **Patients undergoing esophageal stent placement for the treatment of an acute perforation or intrathoracic anastomotic leak were identified from a single institution's prospectively collected database. Patient outcomes were recorded and analyzed. Complications were segregated by stent dwell time.**

*Results.* **During the study period, 162 patients underwent esophageal stent placement for an acute perforation (n = 117) or anastomotic leak (n = 45). Patients whose stent was removed in less than 28 days after placement for an acute perforation realized a stent complication rate that was independently reduced by 39% (odds ratio, 0.61; 95% confidence interval, 0.54 to 0.78; $p < 0.01$), whereas patients whose stent was removed in less than 14 days after placement for an acute perforation realized a stent complication rate that was independently reduced by 56% (odds ratio, 0.44; 95% confidence interval, 0.38 to 0.69; $p < 0.001$).**

*Conclusions.* **Endoluminal esophageal stent placement is a safe and effective treatment for patients with an acute esophageal perforation or intrathoracic anastomotic leak after esophagectomy. Removal of stents at 2 weeks for anastomotic leak or 4 weeks for perforation has the potential to significantly decrease the incidence of complications associated with stent use.**

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Esophageal stent placement for the treatment of an acute perforation or an intrathoracic anastomotic leak after esophagectomy has become a recognized treatment option for selected patients. These patients include patients with an intrathoracic leak without esophageal necrosis or a mucosal injury greater than 6 cm in length. Stent placement for an acute perforation offers the potential advantages of earlier oral nutrition, a reduced hospital stay, and avoidance of the morbidity and recuperation associated with an operative repair while achieving success rates that compare favorably with traditional primary closure [1]. Esophageal stent placement for an anastomotic leak offers the same advantages and appears to significantly reduce the rate of anastomotic stricture requiring treatment compared with reoperative repair or expectant management [2].

However, untoward events have been reported after esophageal stent placement for the treatment of an anastomotic leak or acute esophageal perforation. These include fistulization with vascular structures, migration with distal bowel obstruction, airway fistulization or compression, esophageal necrosis, and stent fracture or degradation. The purpose of this investigation was to identify an optimal stent dwell time that produced a high rate of sealing the perforation or leak while minimizing stent-related complications.

## Patients and Methods

Patients undergoing esophageal stent placement for the treatment of an intrathoracic leak resulting from an acute esophageal perforation or at the site of an intrathoracic anastomosis after esophagectomy were identified from a comprehensive general thoracic surgery database at a single institution cared for by three thoracic surgeons. The institutional review board approved this retrospective review of the off-label use of an esophageal stent for the treatment of an esophageal perforation or anastomotic leak after esophagectomy and waived individual patient consent for this investigation. Patients with a cervical or intraabdominal esophageal perforation or anastomosis after esophagectomy were excluded. Also excluded were patients with an acute perforation associated with a malignancy. Eligible for inclusion were patients

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transferred from other facilities, patients who underwent chemotherapy and/or radiation therapy before esophagectomy, and patients who had undergone an attempt at operative repair of a leak or perforation with subsequent persistent leak requiring stent placement.

A retrospective analysis from a prospectively collected database was performed after eligible patients were identified. Patient demographics, time to oral intake, length of hospital stay, morbidity, mortality, and patient condition 1 month from discharge were all recorded. Any complication related to use of the stent was reviewed. Stent migration within 72 hours of placement was not considered a complication for the purposes of this analysis, but was included in the overall stent migration rates for this study. Stent dwell time for each patient was assessed. In instances when a patient required the replacement of a stent for malposition or migration, the total time a stent was in place was recorded. Complications identified where segregated by esophageal perforation or anastomotic leak and then by stent dwell time for analysis.

### *Patient Evaluation and Stent Placement*

The presence of an intrathoracic esophageal leak from either an acute perforation or at the site of an anastomosis after esophagectomy was documented and localized by diatrizoic acid (Gastrografin; Bracco Diagnostics, Inc, Monroe Township, NJ) or barium esophagram before any treatment. To be considered a significant leak eligible for treatment other than observation, contrast had to be seen leaving the lumen of the esophagus with extravasation into the mediastinum or pleural space (Fig 1). Additionally, all patients being considered for stent placement after an acute esophageal perforation underwent computer-aided tomographic imaging of the neck, chest, and abdomen.

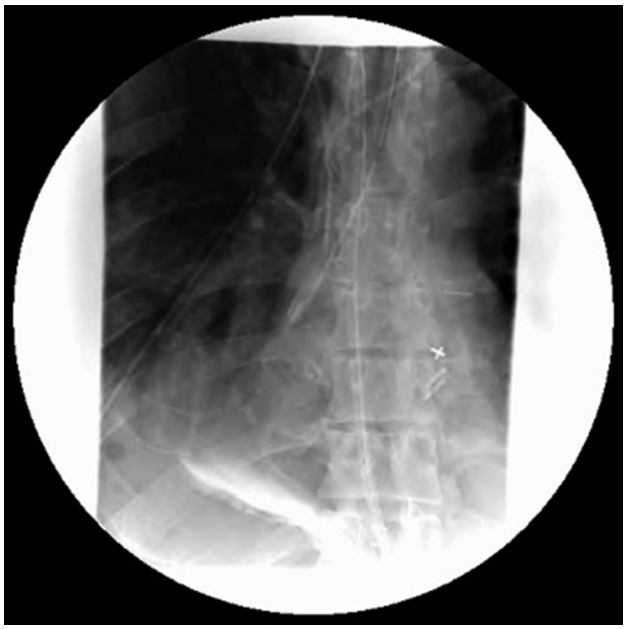

*Fig 1. Esophagram displaying a leak at the site of an intrathoracic esophagogastrostomy after esophagectomy with contrast drained by a tube thoracostomy.*

All esophageal stents were placed in the operating room using general anesthesia and fluoroscopy by a thoracic surgeon after flexible esophagoscopy. It is our practice to routinely oversize esophageal stents in length and diameter to minimize stent migration and achieve a seal of the leak site. Adequate drainage of infected areas was also achieved either by video-assisted thoracoscopic surgery or image-guided percutaneous drainage. Leak occlusion was confirmed by contrast esophagram a minimum of 24 hours after stent placement or when the patient was able to participate in the examination. In the absence of a continued leak, a diet was initiated.

It was the intention to remove all patients' esophageal stents after a sufficient amount of time to allow the leak to seal. This was based on the lack of a leak on esophagram and normalization of clinical, laboratory, and imaging data such as the character and amount of chest tube drainage, resolution of ileus, lack of fever and leukocytosis, and absence of a ipsilateral pleural effusion. Stent removal was carried out in the operating room under general anesthesia. Flexible esophagoscopy was performed before and after stent removal. An esophagram was performed after stent removal before discharge.

### *Statistical Analysis*

Analysis of data was carried out using GraphPad Prism software 4.02 (San Diego, CA) for Windows (Microsoft Corp, Redmond, WA). Continuous data are expressed as the mean ± standard deviation except as otherwise indicated. Differences between categorical variables were evaluated by Fisher's exact test. Differences between continuous variables were measured by two-tailed Student's $t$ test or the Mann-Whitney $U$ test for nonnormally distributed data. A probability value of less than 0.05 was considered significant. Multiple logistic regression analysis was used to study relationships between patient variables and the identified outcome measures. The Poisson distribution, a discrete probability distribution that expresses the probability of a given number of events occurring in a fixed interval of time, was also used to predict the effect of stent dwell times for complications related to the treatment of esophageal perforation or anastomotic leak [3].

## Results

During the 7-year study period, 162 patients with an acute esophageal perforation (n = 117) or an anastomotic leak (n = 45) after esophagectomy were identified as meeting the inclusion criteria for this investigation (Table 1). Each of these patients had either a silicon-coated plastic stent (Polyflex; Boston Scientific, Natick, MA) or a covered nitinol stent (Alveolus Inc, Charlotte, NC) placed at the study institution. All of these stents were fully covered and occlusive. Stent choice was at the discretion of the surgeon.

Thirty-four of these patients had undergone their esophagectomy elsewhere before being transferred to our

*Table 1. Patient Demographics*

| Variable | Anastomotic Leak (n = 45) | Perforation (n = 117) |
|---|---|---|
| Age, y (mean ± SD) | 61 ± 19 | 59 ± 23 |
| Range | (44–73) | (19–89) |
| Nitinol stent | 19 (42%) | 29 (25%) |
| Plastic stent | 26 (58%) | 88 (75%) |
| Preoperative chemotherapy and/or radiation therapy | 38 (84%) | … |
| Mediastinitis | 7 (16%) | 38 (32%) |
| Sepsis | 1 (2%) | 16 (14%) |
| Etiology of acute perforation | | |
| Spontaneous | | 39 |
| Foreign body removal | | 29 |
| Esophageal dilatation | | 29 |
| Endoscopy with biopsy | | 6 |
| Transesophageal echo | | 6 |
| Endoscopic ultrasound | | 3 |
| Endoscopic antireflux procedure | | 3 |
| Previous operative repair | 0 | 26 (22%) |
| Previous stent | 7 (16%) | 11 (9%) |
| Associated procedures with stent | 23 (51%) | 87 (74%) |

SD = standard deviation.

facility for further care. None of the transferred patients had undergone a reoperative repair of their anastomotic leak, although 7 had undergone stent placement before transfer. Similarly, 37 patients were referred for care after an initial surgical repair (n = 26) or stent (n = 11) had been placed for an acute esophageal perforation.

Mean age for each leak group is also displayed in Table 1, as are the frequencies of preoperative chemotherapy and/or radiation therapy for esophagectomy patients and the etiologies of perforation for acute perforation patients. Thirty-eight perforation patients and 7 anastomotic leak patients displayed signs and symptoms of mediastinitis at the time of their evaluation at the study institution defined by chest pain, fever, leukocytosis, dyspnea, and mediastinal fluid collection. Sixteen other acute perforation patients and 1 esophagectomy patient displayed findings consistent with sepsis when evaluated. Eighty-seven perforation patients and 23 anastomotic leak patients underwent at least one additional endoscopic or surgical procedure at the time of stent placement, the most common of which was for enteral feeding access or thoracoscopic decortication of the lung.

Six patients treated for an esophageal perforation and 2 patients with an anastomotic leak did not achieve sealing of their leak after esophageal stent placement and required reoperative repair. Five perforation patients and both anastomotic leak patients went on to have their perforation repair heal without further intervention. One perforation patient experienced a persistent leak after operative repair, which resolved with the subsequent placement of an esophageal stent. These patients were excluded from the dwell time analysis.

Stents were removed in all patients using the criteria previously outlined at a mean of 19 ± 16 days (range, 7 to 51 days) for acute perforation patients and 12 ± 11 days (range, 6 to 39 days) for an anastomotic leak (Table 2). No patient in this series had a stent replaced because of a continued leak after stent removal. Mean hospital length of stay after stent placement was 8 ± 11 days (range, 5 to 31 days; median, 9 days) for acute perforation patients and 9 ± 6 days (range, 3 to 29 days) for anastomotic leak patients. Mean and median follow-up for all patients was 3 ± 2 months and 7 weeks, respectively. All patients were seen in follow-up within 6 weeks of discharge. Three (7%) anastomotic leak patients and 2 (2%) acute perforation patients in this series developed a symptomatic esophageal stricture during the follow-up period.

All stents were placed without intraoperative complication. Stent-related complications included dysphagia requiring removal (n = 23), airway compression (n = 8), stent fracture (n = 21), and vascular fistulization (n = 3; Table 3). Stent migration occurred in 29 (17%) patients. Other associated morbidities in the study population included respiratory failure (n = 12), pneumonia (n = 11), and deep venous thrombosis (n = 7). Multiple complications occurred in 22 (45%) of anastomotic leak patients and 38 (32%) of perforation patients. The two most frequent complications were dysphagia and stent migration (Table 3).

One of the patients experiencing a vascular fistula died. Three other patients died after stent placement for acute perforation as a result of a pulmonary embolism (n = 1), myocardial infarction (n = 1), and sepsis (n = 1). There were no operative mortalities in the anastomotic leak patients treated with stent placement.

Multiple logistic regression analysis found that the rate of complication associated with an esophageal stent for acute perforation was not related to the etiology (including spontaneous perforation; $p = 0.4$), interval from time of perforation to stent placement ($p = 0.1$), previous operative repair ($p = 0.3$), mediastinitis ($p = 0.2$), sepsis at presentation ($p = 0.09$), or type of stent used ($p = 0.3$). Patients whose stent was removed in less than 28 days after placement for an acute perforation realized a stent complication rate that was independently reduced by 39% (odds ratio, 0.61; 95% confidence interval, 0.54 to 0.78; $p < 0.01$) as compared with patients whose stent was removed at or after 28 days. When a Poisson distribution was used to predict the relatively rare rate of patient (not

*Table 2. Results After Esophageal Stent Placement*

| Variable | Anastomotic Leak | Perforation |
|---|---|---|
| Resolution of leak | 43 (96%) | 111 (95%) |
| Stent removal, days (mean ± SD) | 12 ± 11 | 19 ± 16 |
| Range | 6–39 | 7–51 |
| Hospital length of stay, days (mean ± SD) | 9 ± 6 | 8 ± 11 |
| Range | 3–29 | 5–31 |

SD = standard deviation.

*Table 3. Morbidity and Mortality After Esophageal Stent Placement*

| | Anastomotic Leak | | | Perforation | | |
|---|---|---|---|---|---|---|
| Variable | <2 wk (n = 29) | >2 wk (n = 16) | *p* Value | <4 wk (n = 96) | >4 wk (n = 21) | *p* Value |
| Migration | 4 (14%) | 7 (44%) | 0.04 | 9 (9%) | 9 (43%) | 0.0007 |
| Dysphagia | 5 (17%) | 8 (50%) | 0.04 | 4 (4%) | 6 (29%) | 0.0022 |
| Hemorrhage | 0 | 1 (6%) | 0.4 | 0 | 2 (10%) | 0.03 |
| Stent fracture | 3 (10%) | 6 (38%) | 0.05 | 5 (5%) | 7 (33%) | 0.001 |
| Airway compromise | 1 (3%) | 2 (13%) | 0.3 | 3 (3%) | 2 (10%) | 0.2 |
| Respiratory failure | 2 (7%) | 3 (19%) | 0.2 | 3 (3%) | 4 (19%) | 0.2 |
| Pneumonia | 2 (7%) | 2 (13%) | 0.2 | 3 (3%) | 4 (19%) | 0.1 |
| DVT | 1 (3%) | 2 (13%) | 0.3 | 2 (2%) | 2 (10%) | 0.1 |
| Myocardial infarction | 0 | 0 | … | 1 (1%) | 0 | 0.2 |
| Mortality | 0 | 0 | 0.3 | 2 (7%) | 2 (10%) | 0.3 |

DVT = deep venous thrombosis.

multiple events) occurrences of stent related complications for less than and greater than the 4-week mark, 4 patients and 11 patients were derived, respectively. No significant difference in the rate of complications was seen when patients requiring an additional operative or endoscopic procedure in addition to esophageal stent placement when compared to those who did not within each cohort. Stent type was not found to influence the rate of complications in patients with an esophageal perforation.

Similar regression analysis found that the rate of complications associated with an esophageal stent placed for an intrathoracic anastomotic leak was not related to the use of preoperative chemotherapy and/or radiation therapy ($p = 0.3$); type of anastomosis performed ($p = 0.08$); previous operative repair ($p = 0.5$), mediastinitis ($p = 0.2$), or sepsis ($p = 0.1$) at presentation; or type of stent used ($p = 0.02$). Patients whose stent was removed in less than 14 days after placement for an acute perforation realized a stent complication rate that was independently reduced by 56% (odds ratio, 0.44; 95% confidence interval, 0.38 to 0.69; $p < 0.001$) compared with patients whose stent was removed at a time at or greater than 14 days after placement. When a Poisson distribution was used to predict the relatively rare rate of patient (not multiple events) occurrences of stent-related complications for less than and greater than the 2-week mark, 5 patients and 14 patients were predicted, respectively. Stent type was not found to influence the rate of complications in patients with an esophageal perforation.

## Comment

As the available materials for the manufacture of medical devices have improved in the last two decades, a new generation of esophageal stents that are more easily placed and removed has been introduced. These stents also conform more to the esophageal lumen than previous iterations and, when covered with an impervious membrane, can provide an occlusive seal within the esophageal lumen. Such characteristics have caused clinicians to consider the use of esophageal stents for difficult-to-treat disorders of the esophagus beyond the palliation of malignancy.

Beginning in 2001, investigators began to report the ability of an occlusive, removable esophageal stent to treat acute perforations and intrathoracic anastomotic leaks [4]. Several techniques evolved during the next decade, including our preference for a hybrid approach to such patients. This technique emphasized fulfilling the traditional operative goals of treating these conditions substituting the placement of an occlusive esophageal stent for the operative repair of the site of perforation or leak [5]. Subsequent reports of a high rate of success with this approach for patients with an acute perforation, anastomotic leak, or fistula of the esophagus have occurred [6, 7].

However, as with any technique, complications related to the use of an esophageal stent to treat acute perforations or an anastomotic leak have been reported. These reports include benign events such as migration and odynophagia to more concerning instances of migration with bowel obstruction, airway compromise, fistula formation, hemorrhage, stent fracture with difficult removal, and failure of the stent to occlude the leak, requiring more extensive surgery than might have been required initially [8–11]. Unfortunately, some of the listed complications have resulted in death.

It would be expected that any surgical technique would evolve as its use was disseminated and studied by a larger and more diverse group of practitioners. After the initial success with the use of esophageal stent placement for perforation and anastomotic leak, several groups have sought to better define indications and contraindications for this technique. Our report analyzing instances of stent failure in a cohort of 162 treated patients emphasized specific criteria associated with the failure of stent placement in patients with an acute perforation, fistula, or anastomotic leak [1]. Other reports have rightly emphasized the need to identify instances of failure of the stent technique in a timely manner to allow operative repair [12].

In addition to defined indications and contraindications for esophageal stent use, complications may also be minimized by an improved understanding of the impact

of these stents on the esophagus and surrounding structures. One such factor is the radial force found in the modern generation of stents. Hirdes and colleagues [13] found significant variation in the radial force exerted by different types of stents in an ex vivo model. Such radial force is integral to the success of esophageal stent use for acute perforation or anastomotic leak. However, excessive radial force is likely a contributor to some of the reported complications associated with esophageal stent use and too often is likely not considered by clinicians.

This investigation sought to determine whether the length of time an esophageal stent was left in place could influence the rate of significant complications experienced by patients. A relatively high rate of success was found when using an esophageal stent for the treatment of an acute esophageal perforation or intrathoracic anastomotic leak with the use of specific indications and contraindications. A relatively low rate of complications associated with stent use was also found. However, significant untoward effects did occur.

The analysis conducted in this investigation was able to identify break points in time before and after which the rates of complications associated with esophageal stent use changed significantly. Specifically, in patients with an acute perforation, the rate of significant complications was significantly reduced if the stent was removed before 28 days compared with patients who had their stent left in place longer than 28 days. Similarly, patients treated for an intrathoracic anastomotic leak after esophagectomy realized a significantly reduced complication rate related to an esophageal stent when the stent was removed at 14 days compared with those with longer stent dwell times. Furthermore, no instances of a continued leak were identified in patients who underwent earlier stent removal.

These findings represent meaningful information for clinicians to reference when treating patients with an acute perforation or anastomotic leak. Because primary operative repair has not been done, a natural tendency is to leave a stent in place for what might now be seen as an excessive amount of time. The findings of this investigation not only support earlier stent removal but also should lessen concerns about a persistent leak when the stent is removed.

Although representing a relatively large number of patients with an esophageal perforation or anastomotic leak treated with an esophageal stent, this investigation has some weaknesses. Specifically, this is a retrospective study performed at a single institution. Furthermore, because of the small absolute numbers of stent complications, assumptions about the nominal distribution of these events may be invalid. In such cases, the Poisson distribution is more accurate and was used in an attempt to validate the findings of traditional regression analysis. Although the stent removal criteria were uniformly used in the patients in this investigation, there is some subjectivity to their nature. Lastly, although attempts were made in the design of this study to produce comparable patients within each treatment group, the variability in the etiology of the esophageal leak and stent choice may have introduced error into this analysis.

In conclusion, this investigation found that the risk of significant complications related to the use of an esophageal stent to treat an intrathoracic anastomotic leak or acute perforation was significantly reduced when the stent could be removed in less than 14 or 28 days, respectively. Clinicians using this technique are encouraged to adopt systematic criteria for removing esophageal stents such as those outlined, which include stent dwell time. This may allow a significant reduction in the rare but serious complications reported in patients with an acute esophageal perforation or intrathoracic anastomotic leak treated with an esophageal stent.

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## DISCUSSION

**DR TODD L. DEMMY** (Buffalo, NY): This is a great paper, but I was curious, how do you work out the issue of physicians leaving the stents in longer because they thought the intestines had worse endoscopic appearances? Perhaps what you observed was not a consequence of getting stents out sooner but surgeons leaving them in longer because of a greater perceived chance for erosion or other complications from tip necrosis.

Thank you.

**DR FREEMAN**: That is a great question. In our early experience, because we were putting a stent in instead of performing an operative repair, we intuitively thought, well, we have to leave this in for 3 months, and I think we have learned through some of our complications and others of you that have shared complications that you really have to push yourself to get it out earlier. And at 14 to 21 days you probably should remove it and look at the esophagus, and if it's not healing, maybe that patient needs something else. But I think you have to push yourself to get the stents out earlier, which is not intuitive.

If you think about it, most of us who do esophageal surgery think, well, in about 7 days I'll get an esophagram if I do an operation to do an esophagectomy, an anastomosis, or if I do a repair, but if we put a stent in we think, well, we need three times that long to heal, and it's probably not true. At least my human nature is to leave it in longer. I think this shows that we have to push ourselves not to do that.

If at that point you have left it in a sufficient amount of time and it's not healing, it's probably a failure and you need to think about another treatment option.

**DR DANIEL L. MILLER** (Marietta, GA): Nice job. Could you tell us your algorithm for following up your patients after stent placement? As you know, the nitinol stents will completely self-expand within 48 hours after placement. When do you study your patients after stent placement? I usually wait 48 hours. Do they stay in the hospital until you remove the stent? There are a lot of factors here that you need to teach us to better understand stenting for esophageal disease. Our main issue has been stent migration. Usually, I place two stents to telescope them to prevent distal migration, which has worked.

**DR FREEMAN**: We routinely perform an esophagram 48 hours after placement, no earlier, or, if the patient is intubated, when the patient can participate. So I think studying these patients 12 hours later is not helpful.

At that point on the esophagram, if it looks all right, we go ahead and initiate a diet and watch them for about 24 hours, and then if they have a chest tube, get that out per our routine and send them home.

**DR TRAVES CRABTREE** (St. Louis MO): Doctor Freeman, I have a question on the airway compromise. I wouldn't have thought that would have been related to the length of time the stent was in. I would have thought that would have been a stent size and a stricture location issue. Why was there a difference there?

**DR FREEMAN**: So would I, but that's what we found when we looked back, and, again, we use a very large stent. And that particular subset of patients, although it's not large, were older patients. I don't have a specific reason for that. That's something I want to look at a little further. But it did seem to make a difference in how long it was in place.

**DR JOHN NABAGIEZ** (Staten Island, NY): Regarding perforations, not anastomotic leaks, do you stent all of them or do some go to surgery? And of the 3 patients who died, were any of those deaths in any way stent-related, in other words, might they have done better with surgery, or were they too ill to tolerate surgery, or were those deaths unrelated to therapeutic approach? Did you look back on any of that?

**DR FREEMAN**: We presented a paper here a few years ago where we looked at the criteria for not stenting people. Our preference is to stent acute perforations when they come in. We don't stent people who have a large perforation at the GE [gastroesophageal] junction, we don't consider stenting people with a cervical injury, and we don't usually consider stenting people who have greater than a 6-cm perforation. So those people we don't try and stent. We go to operative repair.

**DR MITCHELL MAGEE** (Dallas, TX): Rich, I have had limited experience in patients, but my experience in a few of those patients has not been nearly as good as yours in terms of, one, being able to manage migration. I have seen, particularly in the patients where I don't have another option, for instance, a patient who has come in, had a perforation like a Boerhaave's at an outside hospital, had a good repair, at least as good a repair as could have been done, and then sent in to us for persistent leak after that repair. So going back and reoperating on them is usually not going to be a good option. That patient had a lot of migration, stent in, stent out, actually got a swallow on them and didn't show a leak, and then I fed him and he leaked.

So I am wondering if you have a good formula for assessing whether healing has taken place within that time frame, understanding that you want to try to push it as early as you can. So barium versus Gastrografin? Do you get a CT [computed tomography] scan after your swallow just to be sure that you have got the healing you think you have?

**DR FREEMAN**: If we stent someone and we do the swallow about 48 hours later and the stent has moved, we will go ahead and revise it and/or potentially do a double stent, although we have really only done a handful of those. And at that point if it moves again, unless the patient has a lot of comorbidities or a very good reason not to operate, we consider it a failure and we move them on with an operative repair.

So I think one thing that we have learned the hard way is no technique is perfect for everybody, and if it's not going to work, identify that early and move on.

**DR MAGEE**: So you haven't had any false-negative studies?

**DR FREEMAN**: I can't remember a false-negative study. We use barium. We have radiologists who have become pretty experienced with this.

**DR MAGEE**: Just a routine barium esophagram?

**DR FREEMAN**: Yes.

**DR MILLER**: On the larger stents, if you go midesophageal lesion, you can have intussusception of the esophagus, and if they have a small hiatal hernia, up. So you have really got to watch for midesophageal because we have seen some obstructions. But that's one thing, I would really go big or go home, I agree, but the midesophagus, we have had a few that had intussusception. So I would just watch that.

**DR FREEMAN**: I think that's a valid point. The other thing I would add is our failures, one thing that we have realized fairly recently is large hiatal hernias make it difficult to have success with a stent.

# ABTS Requirements for Maintenance of Certification

The American Board of Thoracic Surgery's Maintenance of Certification program was adopted 7 years ago. Since that time, there has been a continuous evaluation in the Board's thinking about the overall process, based upon internal discussions and input from our diplomates.

These inputs resulted in our decision to migrate from a purely knowledge-based multiple choice exam, utilizing a Pearson Testing Center to a Mastery Learning Process, using a SESATS format. Diplomates, enrolled in this year's (2015) 10-year MOC process, will fulfill their Part III requirement by completion of a home or office-based secure learning exam, following the instructions on the ABTS website.

In brief, you will be directed to a secure website, administered by Software Secure. The only special computer hardware needed will be a camera for your home or office computer (most laptops now come with a built-in camera). Once logged in, you will be asked to verify your identity by holding up your driver's license with your picture next to your face. You will be visually monitored for the time you are logged onto the website.

There are 100 SESATS questions (primarily taken from SESATS X), based on your specialty designation (Adult Cardiac, General Thoracic, Cardiothoracic, and Congenital), that you will need to work through as instructed. The exam will now be modular and tailored to your practice – for example, if your practice is 100% adult cardiac, you will only have adult cardiac and critical care questions. You will have 15 hours with as many as 10 logins to complete the 100 questions during the months of September and October 2015. For those diplomates who have used SESATS in the past, the process of working through the questions is the same. For those who aren't familiar with SESATS, it might be beneficial to purchase and download SESATS X and work through the specialty specific module. This preparation will give you familiarity with the process. While SESATS X may be helpful preparation, it is not required.

The goal of this exam is to provide a learning opportunity using judgement and decision making as well as knowledge. There is no grade involved, but you will be given the percentage of questions you answered correctly on the first try.

Not passing this exam would result from either not completing the 100 questions in the 15 hour and 10 login limit, or by rushing through the questions without reading the critique. The Board and MOC Committee believe that reading the critique is key to the learning process using SESATS. The Software Secure reporting system will allow us to verify the pace of completion and thus limit the passing grades to those who earnestly participate in the process.

The Board sincerely hopes that this pilot of life-long learning is viewed favorably by our diplomates. If the diplomates find this form of learning better than the previous approach that employed a secured multiple choice test administered in a remote testing center, the Board will continue with this new strategy and refine SESATS as we go forward to assure that new standards of care are communicated to members of the ABTS community as part of the MOC process. There will be a brief survey following the last SESATS question which needs to be completed to officially finish the process.

Everyone at the ABTS thanks you for embracing the primary principle of MOC—life-long learning, which is consistent with our obligation to the public trust.