Management of thoracic esophageal perforations

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Abstract

Objective: To assess our results of a prospective algorithm applied to patients with thoracic esophageal perforation. Methods: A retrospective review of a prospective algorithm. Patients with esophageal perforation underwent an esophagram. If there was a contained esophageal perforation they were admitted, kept nothing by mouth, and restudied in 3—5 days. If the leak was not contained, they underwent operative repair. Results: From 1/1998 to 6/2009 there were 81 patients. The gastrograffin swallow showed 56 patients had contained perforations and 25 did not. Twenty-two of the 25 patients with noncontained perforation underwent immediate operative repair (one patient refused surgery, two were not stable enough for the operating room); their morbidity was 68% and there were six (24%) operative mortalities. Median hospital length of stay (LOS) was 11 days (range, 2—120). Of the 56 patients with contained perforations, 26 were managed successfully without surgery. However, 30 of the patients initially treated nonoperatively eventually required operations due to new pleural effusion, mediastinal abscess, or conversion to noncontained perforation. Their morbidity was 41% and there were three operative mortalities (5%). On univariate analysis, these patients were more likely to have undergone previous esophageal procedures (surgical or dilation) (p = 0.03), had new or increased pleural effusion (p = 0.04), and had greater than 24 h between diagnosis and treatment (p = 0.02). Only greater than 24 h between diagnosis and treatment remained a significant predictor on multivariate analysis. Their median hospital LOS was 21 days (range, 7—77). Conclusion: Contained thoracic esophageal perforations can usually be safely managed nonoperatively without significant morbidity or mortality. However, careful in-hospital monitoring is needed if surgery is not chosen.

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Keywords: Esophagus; Esophageal perforation; Boerhaave’s syndrome; Esophageal repair

1. Introduction

Perforation of the thoracic esophagus can be spontaneous following an episode of vomiting or retching or iatrogenic following procedures such as esophageal endoscopy, transeophageal echocardiography, esophageal dilation, or attempted intubation [1,2]. Despite advances in the care of the critically ill patient, esophageal perforation remains an extremely morbid and potentially lethal clinical problem. There are fundamental treatment principles for this group of patients, which include the following: antibiotics, control of sepsis and drainage of pleural and mediastinal spaces, as well as nutritional support [3]. The challenge in managing these patients is amplified by the many clinical variables exhibited and the wide array of injuries, associated co-morbidities, time to presentation, and appropriateness of initial therapy based on the patients’ clinical picture.

This article reviews the experience of a single institution in managing thoracic esophageal perforations including those contained within the mediastinum and those noncontained that drain into the pleural space. In addition, we will focus on patients with initially contained perforations that subsequently required operation during the course of treatment.

2. Materials and methods

All patients who were consulted for and had an esophageal perforation at our institution between 1998 and 2009 were included in this retrospective cohort study of a prospectively collected database. This study was approved by the University of Alabama at Birmingham’s Institutional Review Board. Patients were consented for inclusion in the prospective database used for this study; however, individual patient consent was waived for this particular study. Major morbidity was defined using the Society of Thoracic database
version 2.81 and mortality was defined as death prior to discharge for the admission during which the perforation was initially diagnosed.

The study includes patients who were treated primarily at our institution as well as those who received treatment at an outside hospital prior to transfer. At the time of presentation, the status of the esophageal perforation was evaluated with an esophagram and a computed tomography (CT) scan. For the patients with a confirmed esophageal perforation, a distinction was made between those that were contained within the mediastinum and those that were not contained with perforation into the pleural space. Primary treatment for contained perforations consisted of a strict policy of nothing by mouth, intravenous antibiotics, and enteral or parenteral nutrition. Intravenous antibiotics were continued for a minimum of 7 days with repeat esophagram obtained between 3 and 5 days after presentation or sooner if the patient’s clinical picture implied pleural contamination or a new pleural effusion. If the repeat esophagram showed improvement or resolution of the contained perforation, consideration was given to initiation of oral intake. Patients with noncontained perforations were offered operative drainage with primary esophageal repair. The esophagus was repaired in two layers with an inner mucosal layer followed by an outer muscularis layer. The suture line was covered with a pedicled intercostal muscle flap.

Data were collected using Excel (Microsoft, Seattle, WA, USA), and imported into Statistical Analysis Software (SAS) v. 9.1 (SAS Institute, Cary, NC, USA). Descriptive statistics were used to estimate the frequency and medians of the study variables. Differences between study groups in baseline characteristics and clinical outcomes were assessed with the use of two-sided Fisher’s exact tests and chi-square tests for categorial variables and a nonparametric variance for analysis was performed (Mann–Whitney). Multivariate logistic regression analysis was performed using a backwards stepwise model. Variables with \( p < 0.08 \) on univariate analysis were included in the multivariate model.

### 3. Results

During the study period, there were 81 patients treated for esophageal perforation at our institution. The patient characteristics and presenting symptoms are listed in Table 1. Radiographic examination showed that 56 of these patients had perforations contained within the mediastinum; the remaining 25 patients had noncontained perforations draining into the pleural space. There were no statistically significant differences in the gender, age, co-morbidities, or presenting symptoms of these two groups of patients. The causes of esophageal perforation are listed in Table 2. The perforation was iatrogenic in 45% of the contained group and 40% of the noncontained group. Spontaneous perforation was the second most common etiology in both groups. Table 3 lists the procedures performed for those patients from each group who underwent operation. The operations were classified as drainage of the pleural and mediastinal spaces with primary esophageal repair versus drainage alone. In addition, a select group of patients had an esophageal stent placed in addition to another procedure (three patients in the noncontained group) or as primary therapy (two patients in the contained group). Those three patients in the noncontained group had a persistent leak after attempted primary repair. All three were successfully managed with an esophageal stent that was removed after 1 month. The two patients with stents as primary therapy in the contained group both had esophageal malignancy. The stents were placed to allow completion of neoadjuvant therapy and were removed at the time of ultimate resection.

The outcomes of this patient cohort are listed in Table 4. The initial management of the contained esophageal perforations consisted of nothing by mouth, intravenous antibiotics, and enteral or parenteral nutritional support. Repeat esophagram was obtained between 3 and 5 days after presentation or sooner if there was a change in clinical status such as leukocytosis, fever, or new pleural effusion.

Thirty of the 56 (54%) patients in the contained group eventually required operation (16 for drainage plus repair, 12 for drainage only, and two for stent placement). Majority of these operations were for drainage of a mediastinal fluid collection or new pleural effusion to ensure drainage of infected phlegmon. However, three of these patients (5% of the overall contained group) underwent operation because the follow-up esophagram showed that the esophageal perforation was now noncontained and draining into the pleural space. Table 5 shows the result of the univariate analysis of the patients who had a contained perforation stratified by having or not having an operation. The contained patients eventually requiring operation were more likely to have had some type of previous esophageal procedure (surgical or dilation) \( (p = 0.03) \), had new or increased pleural effusion \( (p = 0.04) \), and had greater than 24 h between diagnosis and treatment \( (p = 0.02) \). Only delay in treatment (greater than 24 h between diagnosis and treatment) remained a significant predictor on multivariate analysis. The contained patients who underwent operation had a major morbidity in 24 (80%) compared to only 5 (19%) in the nonoperative patients \( (p < 0.001) \). The major morbidity for the overall group of contained patients was 43%.

There were three deaths in the contained group corresponding to a mortality of 5%. One of these patients had an iatrogenic perforation diagnosed greater than 24 h after the injury. This patient underwent operation for drainage of a new pleural effusion but eventually died from multi-system organ failure. Another patient had an iatrogenic perforation and was transferred to our institution greater than 24 h from the time of injury. This patient did not require operation but also died from multi-system organ failure. The final patient also had an iatrogenic perforation. This patient was transferred from an outside hospital greater than 24 h from time of injury and underwent operative drainage of a mediastinal fluid collection. There was a history of coronary artery disease with eventual mortality from a postoperative myocardial infarction and sequela of heart failure.

All 25 of the noncontained patients were offered operation for drainage and possible repair. One patient refused operation. Two additional patients were septic and too hemodynamically unstable to undergo operation. Of
these two patients, one perforation was spontaneous and the other was iatrogenic. Both patients were treated with bedside chest drain tube drainage, intravenous antibiotics, and supportive care. Both patients had been transferred to our hospital greater than 24 h from time of injury and both eventually died of multi-system organ failure. There were four additional deaths who did undergo operation for an overall mortality in the noncontained group of 24%. Of these four deaths, three of the perforations were iatrogenic and one was spontaneous. All were transfers from other hospitals with only one being within 24 h of injury. Three of these deaths were from multi-system organ failure with the last one being from anoxic brain injury during cardiac arrest prior to transfer. The morbidity in the noncontained group was 68%, as listed in Table 3.

4. Discussion

Perforation of the thoracic esophagus is a clinical entity with a long-recognized potential for morbidity and mortality [4]. The two most common etiologies include spontaneous post-emetic rupture and iatrogenic perforation. The first description of a spontaneous esophageal perforation by the Dutch physician, Hermann Boerhaave in 1724, has been cited in numerous manuscripts and textbooks. For many years, spontaneous perforation was the primary etiology of thoracic perforations. However, with the introduction of advanced endoscopic therapies, iatrogenic perforations have accounted for a larger proportion of thoracic esophageal injuries. Clinical suspicion of an esophageal perforation often prompts an esophogram to further evaluate. The false negative rate of these studies should not be underestimated [5]. Many of these patients have also obtained a CT scan to examine the mediastinum and pleural space for possible abscess or effusion. Whether the perforation is contained in the mediastinum remains an important issue in coordinating further therapy. Patients presenting within 24 h with a noncontained perforation are typically offered operation for drainage of the pleural space, drainage and debridement of the mediastinum, and esophageal repair [6]. An important adjunct to operative repair is providing soft tissue coverage of the esophagus [7]. This can consist of a pedicled flap of thickened pleura or pericardial fat but is more commonly an intercostal muscle flap [8,9]. The omentum has also been described as useful coverage in certain circumstances [10]. For a noncontained perforation presenting greater than 24 h from the injury, many authors have advocated drainage only citing the failure of attempted repair of inflamed esophageal tissues [11,12]. To counter this argument, several case series have documented acceptable results with primary esophageal repair regardless of the time to presentation [9,13—16]. Whether the treatment of a noncontained thoracic esophageal perforation includes repair or drainage, this remains a critically ill group of patients with a high morbidity and mortality [4,17—19]. All of the patients in our series with a noncontained perforation were offered operation. This group of patients had an overall morbidity of 68% and a mortality of

<table>
<thead>
<tr>
<th>Table 1. Patient characteristics and presentation.</th>
<th>Contained, N = 56</th>
<th>Non-contained, N = 25</th>
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</thead>
<tbody>
<tr>
<td>Male</td>
<td>29 (52%)</td>
<td>14 (56%)</td>
</tr>
<tr>
<td>Female</td>
<td>27 (48%)</td>
<td>11 (44%)</td>
</tr>
<tr>
<td>Age, median (range)</td>
<td>67 (19—88)</td>
<td>58 (20—86)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comorbidities</th>
<th>Contained, N = 56</th>
<th>Non-contained, N = 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achalasia/stricture (with dilations)</td>
<td>5 (9%)</td>
<td>8 (32%)</td>
</tr>
<tr>
<td>Psychiatric history (severe depression, alcohol abuse, bipolar, schizophrenia, psychotic, mental retardation)</td>
<td>7 (13%)</td>
<td>4 (16%)</td>
</tr>
<tr>
<td>Coronary artery disease, hypertension</td>
<td>14 (25%)</td>
<td>10 (40%)</td>
</tr>
<tr>
<td>Gastroesophageal reflux disease</td>
<td>1 (2%)</td>
<td>2 (8%)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>6 (11%)</td>
<td>4 (16%)</td>
</tr>
<tr>
<td>Neurologic disorders (Guillain-Barre, seizure disorders)</td>
<td>3 (5%)</td>
<td>0</td>
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</tbody>
</table>

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<thead>
<tr>
<th>Table 2. Causes of esophageal perforation.</th>
<th>Contained, N = 56</th>
<th>Non-contained, N = 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iatrogenic</td>
<td>25 (45%)</td>
<td>10 (40%)</td>
</tr>
<tr>
<td>Spontaneous</td>
<td>13 (23%)</td>
<td>8 (32%)</td>
</tr>
<tr>
<td>Other (trauma, food impaction, foreign body)</td>
<td>18 (32%)</td>
<td>7 (28%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3. Procedures performed in those patients undergoing operation.</th>
<th>Contained, N = 30</th>
<th>Non-contained, N = 22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair plus drainage</td>
<td>16 (53%)</td>
<td>15 (68%)</td>
</tr>
<tr>
<td>Drainage only</td>
<td>12 (40%)</td>
<td>7 (32%)</td>
</tr>
<tr>
<td>Stent</td>
<td>2 (7%)</td>
<td>3 (14%)</td>
</tr>
</tbody>
</table>

* Some patients had more than procedure.
24%, consistent with reported results in the literature [9,14,20,21]. The initial treatment of a thoracic esophageal perforation that is contained within the mediastinum often involves nonoperative management [11]. As in our series, these patients are managed with nothing by mouth, intravenous antibiotics, and enteral or parenteral nutrition [12]. However, these patients require close monitoring to ensure no change in clinical status that may warrant operative intervention. In our series, 54% of the initially contained esophageal perforations required an operation during their hospital course. Not all of these procedures were directly related to the esophagus. Majority of these operations were for drainage of the mediastinal and/or pleural space due to concern of evolving phlegmon or abscess. The morbidity of the contained patients who required operation was significantly higher than those contained patients who did not require an operation. Univariate analysis of patients presenting with a contained perforation identified previous esophageal procedures, new or increasing pleural effusion, and presentation greater than 24 h from the injury as predictive of needing an operation. Of these factors, only presentation greater than 24 h remained significant on multivariate analysis.

For those patients who were transferred from outside hospitals, if the patient was intubated after the diagnosis of the perforation, decisions on surgical management were based on the esophagram obtained prior to intubation. If an intubated patient was suspected of having an esophageal perforation and had not had a prior esophagram, a CT scan was obtained to evaluate for mediastinal or pleural fluid collections. If there was an undrained fluid collection with clinical signs of sepsis, operation was performed for drainage. Only those patients ultimately confirmed to have a perforation were included in this analysis.

Those patients who have a contained perforation at presentation, may or may not show signs of clinical instability, and have a noncontained perforation at repeat esophagram constitute an important group. At our institu-
subsequent delay in starting antibiotic therapy does have a significant impact on the morbidity of esophageal perforation patients as well.

A suggested algorithm for the management of thoracic esophageal perforations as performed at our institution is listed in Fig. 1. An esophagram and CT scan are obtained in all patients to document whether the perforation is contained within the mediastinum as well as the presence or absence of a pleural or mediastinal fluid collection. If there is extravasation of contrast into the pleural space, operation is recommended for drainage of the pleural space, debridement and drainage of the mediastinum, and possible esophageal repair with additional soft tissue coverage. The decision of drainage only versus drainage plus esophageal repair is determined intra-operatively by the quality of the esophageal tissue and the overall condition of the patient. For those patients with contained perforations, the initial management consists of nothing by mouth, intravenous antibiotics, and enteral or parenteral nutritional support. For those patients who remain clinically stable, the esophagram is repeated in 3–5 days from the time of presentation. The esophagram is repeated sooner for any measure of clinical instability such as leukocytosis, fever, or new pleural effusion. For clinical instability and an esophagram that continues to show a contained perforation, consideration is given to operative drainage of a pleural effusion if present and the mediastinum for possible early mediastinal abscess. While not commonly used at our institution as primary therapy, esophageal stents remain an additional option. Stents have been shown to require close radiographic and endoscopic follow-up to ensure no migration and continued coverage of the esophageal defect [23,24]. If stenting is considered, an upper endoscopy is performed at presentation to define the exact location and extent of injury. Endoscopy also allows an assessment of distal esophageal obstruction or additional pathology that would affect healing and treatment options.

In conclusion, there are different approaches to the management of a thoracic esophageal perforation depending on the specific circumstances of the patient at the time of presentation. For the subset of patients with contained perforations that are managed nonoperatively, it is important to maintain close monitoring for changes in clinical status particularly for those patients who present greater than 24 h from the time of injury. A contained perforation can become a noncontained perforation with the potential for drastic consequences for the patient. Prompt diagnosis and appropriate treatment can allow ultimate survival for the patient with this challenging clinical problem.

References

I have three questions. In that respect, I think these figures are well in line with what we can find today in the recent noncontained perforation. We haven't used stents with great frequency. Part of that has been related to the location of the perforations. With the ones that are very small, we don't think that stents will be useful because they don't have an inflammatory reaction to the stent, and these perforations may close on their own.

Appendix A: Conference discussion

Dr A. Lerut (Leuven, Belgium): In this large series, 56 were contained perforations and 25 were noncontained, and that distinction in fact is, in your center, the basis of your therapeutic algorithm. Basically this consists of performing, or trying to perform, nonsurgical treatment in a clinically stable patient with a contained perforation, while surgery is advocated in a clinically unstable patient with a contained perforation or in all patients with a noncontained perforation.

As for your results, the overall mortality is 11%, being 5% for the contained and 24% for the noncontained, the latter, of course, the most difficult group. I think these figures are well in line with what we can find today in the recent literature, especially in the noncontained group where we still, as we all do, struggle to get those patients safely through the problem. In that respect, I have three questions.

The 24-hour rule has traditionally been considered as a predictor for mortality, and that has withstood the test of time, as obviously also is the case here in this series. Now I belong to an older generation, and there was once a time that the 24-hour delay was in fact an indication for doing an operation rather than a primary repair. In fact, there is a fantastic series from Altojury in Hungary who has done 27 esophagectomies and reconstructions during the same operation. Sixteen out of those patients had a delay of more than 24 hours, some of them even up to 3 or 4 days, and yet he had a very low mortality. In fact only one patient, 3.7%. That brings me to my first question.

Like all this nowadays I think, you are also focusing on saving the esophagus, especially in the unstable patients, but perhaps the higher the morbidity, the higher the indication for doing an esophagectomy rather than trying to save the esophagus. So that's my first question, whether with a mortality of 24% esophagectomy could have been in some of those patients a better alternative than an attempt to do a primary repair.

That brings me to the second question. In the paper there are no results on functional outcome. Mark Orringer has done a detailed study on that, and actually it appears that after primary repair, the results are not so brilliant and, in fact, in almost 50% a resection was required afterwards. So that brings me to my question. Can the original underlying pathology be a predictor, yes or no, for an indication towards immediate esophagectomy, again, in the noncontained group particularly?

My second question is maybe a personal bias. In your series you had 13 patients with perforated achalasia. Now, for us it's now more than 15 years since we stopped doing any operation for these patients, because they have a well-prepared esophagus. It's clean, and thus when they get the perforation, I think today with the modern technology one can handle those patients perfectly in a conservative way combined with CT-guided drainage with the cooperation of an interventional radiologist. So my question is, in the achalasia group, do we really need to do surgery rather than conservative treatment combined with interventional radiology/CT-guided drainage?

Dr Minnich: With regards to the consideration of esophagectomy in the high-risk group patients, our approach has been for the hemodynamically unstable or higher-risk patient to favor drainage for control of the sepsis and stabilizing the patient initially. I think there is always something of a concern about doing an anastomosis in an infected field, and a perforation having been present for greater than 24 hours, in the unstable patient, there is often a significant level of mediastinal contamination in those circumstances. Certain institutions that you mentioned have had very good or acceptable results, suggesting that in a select group of patients that that might actually be the preferred therapy, but that has not been our approach for that group of patients for those reasons.

With regards to functional outcome, I agree that it would be very useful to have had this for these patients. Unfortunately, we did not have it for them. Regarding Dr Orringer's data, yes, that may provide some additional direction for those specific patients, but unfortunately we do not have the data for this group of patients.

With regard to the operations for the patients with achalasia, these patients were still managed with the 24-hour rule that we provided, and those with a contained and stable perforation, mostly the ones that were iatrogenic as well-prepared esophagus, it's clean, and thus when they get the perforation, I think today with the modern technology one can handle those patients perfectly in a conservative way combined with CT-guided drainage with the cooperation of an interventional radiologist. So my question is, in the achalasia group, do we really need to do surgery rather than conservative treatment combined with interventional radiology/CT-guided drainage? Dr Minnich: We haven’t used stents with great frequency. Part of that has been related to the location of the perforations. With the ones that are very small, we don't think that stents will be useful because they don't have an inflammatory reaction to the stent, and these perforations may close on their own.
proximal and still had some tumor present distally, which provided a better fixation point for the stent. I agree that that is an important modality to consider. Dr Blackmon in Houston and Dr Freeman in Indianapolis have reported very good results in using esophageal stents as primary therapy. I think one point to keep in mind with that is, and I’m sure you know as you are doing more, it does require close follow-up after the procedure with repeat esophagrams, sometimes repeat endoscopic procedures, maybe moving the stent, manipulation of the stent, placing another stent. So I think maybe as the technology of the stents improve, that will likely encompass a larger proportion of the primary treatment of these patients, but I think that having a distal portion of esophagus to affix the stent to is always going to be an issue for the distal perforations.

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### Editorial comment

**Management of esophageal perforations: is there a place for a standardized approach?**

Since its first description, esophageal perforations continue to present a diagnostic and therapeutic challenge, despite decades of clinical experience. Diagnosis remains challenging, management remains controversial, and mortality remains high. Accurate diagnosis and prompt treatment are essential for the successful management of these patients. However, presentation is often ambiguous or atypical, and can result in consequent diagnostic errors, leading to delayed treatment with a high related mortality [1]. In this context, a consensual approach should be extremely relevant in the management of this critical issue, where each case is classically considered on an individual case basis.

In an article published in this issue of the journal, Minnich et al. [2] report on 81 patients presenting esophageal perforations over an 11-year period. The authors are to be congratulated in tackling this important issue. They have proposed a pragmatic algorithm taking into account results of repeated esophagograms defining contained or non-contained perforations. The gastrograffin swallow showed that 56 patients had contained perforations and 25 did not. Twenty-two of the 25 patients with non-contained perforation underwent immediate operative repair. Their related morbidity and mortality rates were 68% and 24%, respectively. Of the 56 patients with contained perforations, 26 were managed successfully without surgery. However, 30 of the patients initially treated non-operatively required operations (54%). Their related-morbidity and mortality rate were, respectively, 41% and 5%.

The present article deserves several points of discussion. First, the study population of this report includes a mix of several causes of perforations. As it is well reported, esophageal perforations represent a heterogeneous group of diseases, ranging from iatrogenic perforations on normal esophagus to spontaneous perforations with a high related-mortality. In a recent review of the literature, Brinster et al. have well demonstrated that locations and etiologies form the bases of the decision-making process to manage esophageal perforations [1]. Spontaneous esophageal perforation was associated with the highest mortality rate of 36%, iatrogenic perforations usually followed instrumentation and, therefore, were less difficult to diagnose and to manage, with a mortality rate of 19%. Traumatic perforations were often confined to the upper esophagus with limited dissemination of contamination, and mortality usually resulted from associated injuries, with a rate of 7%. In this report, because the etiologies of perforations have not been taken into account, the conclusions that can be reached from the proposed algorithm management remain limited to the simple consideration of contained or non-contained perforation. Moreover, the authors have not incorporated the interval period from perforation to initiation of treatment. This is of paramount importance when considering that primary repair is difficult to propose after 72 h [3].

Second, the article highlights the need for a prompt diagnosis and continues to support the esophagogram as the best method for management. However, the complexity of each situation leads to consider several techniques for the establishment of prompt diagnosis. As a result, the best method for diagnosis of esophageal perforation is still debated. The contrast esophagogram remains the well-accepted method in the diagnosis of esophageal perforation. A positive result clearly indicates the level of perforation as well as the extent of contamination in the pleural space. Contrast studies have an overall false-negative rate of 10–20% [4]. Because a negative result cannot rule out the possibility of perforation, an accurate diagnosis may require computed tomography (CT), flexible esophagoscopy, or both. Moreover, the esophagogram has an important limitation: it is not applicable for patients in critically ill situations requiring immediate ventilatory support for acute respiratory failure. In this setting, CT seems to be the most appropriate method, and it is likely to represent the first-line method for the diagnosis of esophageal perforation. CT is useful when perforations are difficult to locate or diagnose and when contrast esophagography cannot be performed; and the CT scan is frequently proposed in localizing pleural fluid collections and guiding drainage catheter placement. Moreover, CT allows eliminating other serious conditions such as aortic dissection and pulmonary embolism in patients with acute chest pain. By contrast, flexible esophagoscopy provides direct visualization of the perforation and provides evident details to determine the etiology of the perforation.