
Esophageal Perforation Management Using a Multidisciplinary Minimally Invasive Treatment Algorithm

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BACKGROUND: The surgical management of esophageal perforation (EP) often results in mortality and significant morbidity. Recent less invasive approaches to EP management include endoscopic luminal stenting and minimally invasive surgical therapies. We wished to establish therapeutic efficacy of minimally invasive therapies in a consecutive series of patients.

STUDY DESIGN: An IRB-approved retrospective review of all acute EPs between 2007 and 2013 at a single institution was performed. Patient demographic, clinical outcomes data, and hospital charges were collected.

RESULTS: We reviewed 76 consecutive patients with acute EP presenting to our tertiary care center. Median age was 64 ± 16 years (range 25 to 87 years), with 50 men and 26 women. Ninety percent of EPs were in the distal esophagus, with 67% of iatrogenic perforations occurring within 4 cm of the gastroesophageal junction. All patients were treated within 24 hours of initial presentation with a removable covered esophageal stent. Leak occlusion was confirmed within 48 hours of esophageal stent placement in 68 patients. Median lengths of ICU and hospital stay were 3 and 10 days, respectively (range 1 to 86 days). One-third of the patients were noted to have prolonged intubation (>7 days) and pneumonia that required a tracheostomy. One in-hospital (1.3%) mortality occurred within 30 days. Median total hospital charges for EP were \$85,945.

CONCLUSIONS: Endoscopically placed removable esophageal stents with minimally invasive repair of the perforation and feeding access is an effective treatment method for patients with EP. This multidisciplinary method enabled us to care for severely ill patients while minimizing morbidity and mortality and avoiding open esophageal surgery. (*J Am Coll Surg* 2014; 218:768–775. © 2014 by the American College of Surgeons)

Esophageal perforation is a rare but potentially lethal condition that requires prompt recognition and management to achieve a favorable outcome. Esophageal perforations (EP) are typically classified as iatrogenic, associated with

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either diagnostic or therapeutic endoscopic or surgical procedures, or spontaneous, such as Boerhaave's syndrome. The majority of perforations are iatrogenic in origin and are located in the thoracic rather than the cervical or intra-abdominal esophagus.¹ Despite aggressive therapy, the mortality rate of thoracic and abdominal perforations remains as high as 20% in recent published reports.^{2,3}

Traditional management of thoracic and abdominal EP has been prompt surgery, with primary repair of the perforation the preferred approach in a patient without underlying esophageal pathology or prolonged inflammation.⁴ Despite data suggesting that early surgical repair of perforations is the preferred approach, up to 30% of repairs demonstrate a persistent leak and may require additional esophageal procedures.⁵ Although many authors

advocate for open, operative management of esophageal perforations, others have demonstrated excellent outcomes with nonoperative treatment of perforations and percutaneous control of mediastinal sepsis. Vogel and colleagues⁶ reported no deaths and 96% esophageal healing in a group of 28 patients with thoracic perforations treated nonoperatively. With the development of self-expanding covered stents used for treating both benign perforations and anastomotic leaks in the esophagus,⁷ we reasoned that stent occlusion of an EP could be combined with laparoscopic or thoracoscopic surgical drainage and/or repair with enteral nutritional access to effectively treat esophageal perforations.

Esophageal stenting and nonoperative management was developed and implemented using a multidisciplinary minimally invasive protocol for the treatment of EP. We previously reported our pilot series of our first 11 patients.⁸ Herein, the results of all patients with EP treated under this protocol since 2007 are reported. The results support the effectiveness of a stent-first strategy in treating esophageal perforation at a high volume esophageal disease treatment center.

METHODS

An IRB-approved retrospective review of acute EP between 2007 and 2013 was performed. Patient demographic, clinical outcomes data, and hospital charges were collected. We reviewed our series of 76 consecutive EP patients, who presented or were transferred to our tertiary care center between July 2007 and January 2013. All patients were managed according to our treatment algorithm for acute EP (Fig. 1). Diagnostic management included a water-soluble contrast study performed as an esophagram or CT of the chest using Gastrografin (Bracco Diagnostics Inc). Patients who were noted to have a contained leak within the mediastinum were treated with intravenous antibiotics and chest-tube drainage, if appropriate. Patients noted to have uncontained esophageal contrast extravasation were treated with an endoluminally placed covered esophageal stent and laparoscopic and/or video assisted thoracoscopic surgery with drainage of the posterior mediastinum. These patients also received laparoscopic enteral feeding access, usually in the form of a feeding jejunostomy. Patients who had an uncontained leak within the abdominal cavity were managed based on time elapsed from initial presentation to radiographic study. Patients who presented within 24 hours and had an uncontained abdominal leak were taken to the operating room for primary EP repair and a 360-degree loose fundoplication in order to cover the primary repair. If the esophageal perforation

was greater than 2 cm, an esophageal stent (Alveolus Alimaxx, Merit Medical Endotek) was also used to aid with appropriate coverage and sealing of the esophageal perforation. The size of perforation was measured endoscopically at the time of initial stent placement. For patients who presented beyond 24 hours from the injury, the treatment protocol involved esophageal stenting, drainage, and distal enteral feeding access. In all cases after stent placement, occlusion of the esophageal perforation with stent was confirmed within 24 to 48 hours with either an esophagogram or CT of the chest.

If leak occlusion was verified, nonintubated patients were started on a clear liquid diet and advanced to full liquid diet until their outpatient follow-up appointments. The patients were also discharged home on nocturnal cycled enteral feeds for nutritional support. The patients returned 4 weeks post-stent placement for outpatient stent removal and follow-up esophagogram. All patients were assessed in clinic for symptoms of dysphagia or other esophageal disorders after their esophageal stent was removed. If the leak was not occluded with the initial stent placement, repeat endoscopy and repositioning of the stent were undertaken. Patients with successful stenting were evaluated on a daily basis with chest x-rays to detect evidence of stent migration. If stent migration occurred, or the clinical condition deteriorated, the patient was reevaluated with an esophagogram, and endoscopic repositioning of the esophageal stent was carried out. This management algorithm was repeated until leak occlusion was confirmed and maintained. If a leak occurred at the proximal end of the esophageal stent, an additional stent was deployed, creating a stent-within-a-stent to ensure occlusion.

RESULTS

We reviewed 76 consecutive patients with acute esophageal perforation treated at our tertiary-care center. Forty-nine patients were hospital-to-hospital transfers, and 27 patients presented primarily to our center. The demographics of our patient population are shown in Table 1. The median and mean ages were 64 and 61, respectively (range 25 to 87 years; SD \pm 16 years). There were 11 patients who were 80 years or older and 34% were older than 70 years. There was a male predominance, with 50 men and 26 women within our group. Sixty-four patients were Caucasian, 9 were African-American and 3 were Hispanic (Table 1). The majority of our EP ($n = 69$) were located in the distal esophagus within approximately 4 cm of the gastroesophageal junction. The remaining esophageal perforations were in the mid-thoracic ($n = 5$) and cervical esophagus ($n = 2$).

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