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Endoscopic therapies for acute esophageal perforations and leaks

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ABSTRACT

Esophageal perforation is a serious condition with high morbidity and mortality. Management is optimized by prompt recognition and intervention in the context of a multidisciplinary approach. Specific treatment is dependent upon several factors, including clinical status, type and location of perforation, concomitant esophageal pathology, time delay to intervention, and available expertise. From a technical perspective, the principles of therapy include perforation closure, diversion, and drainage. Minimally invasive endoluminal therapy, including clips, stents, endoscopic suturing, and vacuum-assisted sponge therapy, represents a viable option in selected cases. Proper patient selection, technical proficiency, and recognition of the advantages and caveats of available devices are important determinants of successful endotherapy and clinical outcome.

1. Introduction

Esophageal perforations and leaks are associated with high morbidity and mortality. In a recent pooled analysis of 75 studies, the overall mortality was 12% and the mean hospital stay was 33 days. Therapy initiated within 24 hours of perforation resulted in a mortality rate of 7.4% as opposed to 20.3% in patients treated after that time interval [1]. The last decade has witnessed a shift in management strategy from aggressive surgical intervention to minimally invasive endoluminal therapy, combined with percutaneous drainage of fluid collections and abscesses, in selected patients. Favorable outcomes for nonoperative management are, in part, because of advances in endotherapy for perforation closure, diversion, and drainage. This review highlights recent advances in endoscopic techniques and principles of endoscopic management for acute esophageal perforations and anastomotic leaks.

2. Etiology and diagnosis

Iatrogenic injury is the cause of esophageal perforation in approximately 50% of cases [2]. Perforation during diagnostic procedures can result from blunt trauma due to difficult endoscopic intubation, passage of a side-viewing endoscope or transesophageal echocardiography probe into an unrecognized obstruction, and use of excessive force when negotiating a stricture or an impacted food bolus. Treatment-related perforations can occur from procedures such as dilation of strictures and achalasia, foreign body removal, food disimpaction, endoscopic mucosal resection, and endoscopic submucosal dissection. Other causes of perforation include Boerhaave syndrome, caustic and penetrating injury from a foreign body, eroding malignancy, and postoperative anastomotic disruptions.

As the systemic inflammatory response syndrome and septic shock can develop rapidly following esophageal perforation, early diagnosis is of paramount importance so that prompt therapy can be initiated to decrease morbidity and mortality [3]. Most iatrogenic perforations can be recognized intraprocedurally, providing the best scenario for immediate endoscopic intervention to seal the defect and prevent extraluminal contamination. In cases of suspected esophageal perforation, a chest radiograph may show pleural effusion, pneumothorax, pneumomediastinum, subcutaneous emphysema, and free air under the diaphragm (Figure 1). A water-soluble contrast esophagram or computed tomography study of the chest with oral contrast (Figure 2) can confirm the size and location of a suspected perforation and assess whether the perforation is contained or not. Computed tomography may not only identify the perforation but also guide additional measures for control of infection, such as chest tube placement for large pleural effusions, operative drainage for mediastinal fluid collections and abscesses, and decortication for empyema [4].

3. Principles of management

Intensive monitoring and resuscitation, control of infection, nutritional support (enteral or parenteral), and specific management of the perforation via closure, drainage, and diversion

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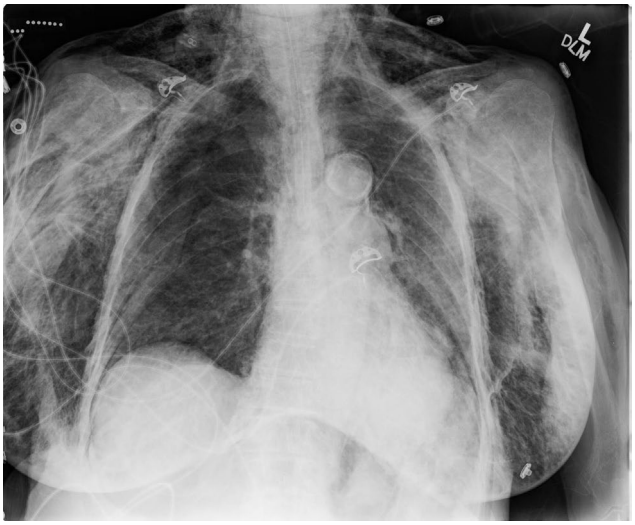

Fig. 1. CO_2 cryotherapy-induced esophageal perforation with bilateral pneumothorax and extensive subcutaneous emphysema on chest radiograph.

procedures are key determinants for a successful outcome. Treatment is individualized but administered in the context of a multidisciplinary approach that involves the intensive care specialist, endoscopist, interventional radiologist, and thoracic surgeon. The direction of approach, whether conservative, endoscopic, surgical, or any combination thereof, is based upon consideration of several factors, including type, size and location of injury, underlying esophageal pathology (eg, cancer), clinical status and comorbidity, time delay to intervention, severity of extraluminal contamination, available resources, and local expertise.

Conservative management consists of intensive care unit monitoring initially, avoidance of oral intake, intravenous fluids, broad-spectrum antibiotics, and selective antifungal coverage, with or without nasogastric tube placement. Criteria for conservative management include early diagnosis of intramural perforation, contained perforation within the neck or mediastinum with free drainage back into the esophagus on contrast esophagram, absence of obstructive esophageal disease, and minimal symptomatology without evidence of systemic inflammatory response syndrome or sepsis [5].

Fig. 2. CT performed for suspected perforation postpneumatic dilation of achalasia showing visible perforation of the left side of the distal esophagus (arrow) associated with pneumomediastinum and small left pleural effusion. (Color version of figure is available online.)

Patients with hypopharyngeal and cervical esophageal perforations can usually be managed conservatively because of containment by fascial structures in the neck. Moreover, endoscopic closure with clips or diversion with stents is not usually feasible because of the confined working space and risk for foreign body sensation. When necessary, ongoing cervical leaks can be managed by neck incision and drainage, with primary repair if possible.

In contrast, thoracoabdominal esophageal perforations often result in significant extraluminal contamination, necessitating restoration of luminal integrity. In this setting, endoscopic closure or diversion can be attempted for intraprocedural and early (within hours) postprocedural perforations. Endoscopic insufflation is minimized and CO_2 is used instead of air as the former is more rapidly absorbed. Clips can effectively close fresh esophageal perforations that are <2 cm in size, whereas larger perforations can be sealed by temporary placement of self-expandable plastic (SEPS) or self-expandable metal stents (SEMS), with or without defect approximation with endoscopic suturing. Stents are also preferable for sealing of iatrogenic perforation and palliation of dysphagia in patients with unresectable malignant esophageal obstruction. In patients who are initially managed nonoperatively, surgical intervention becomes necessary if clinical instability ensues, free contrast extravasation is seen on repeat imaging, or the level of extraluminal contamination worsens.

Following endoscopic intervention, contrast studies are recommended to document successful closure of the perforation, either intraprocedurally or within 24 hours of the procedure. Continuous monitoring for worsening of clinical status is mandatory, with repeat imaging studies as clinically indicated. There is no consensus regarding timing of resumption of oral intake after successful conservative or endoscopic management and satisfactory clinical progress. In nonventilated patients, liquid intake may be initiated 2-3 days after the intervention and slowly advanced to a mechanical soft diet in those with stents in place.

4. Endoscopic modalities

4.1. Through-the-scope clips

4.1.1. Devices and technique

Standard through-the-scope (TTS) clips can readily close small esophageal perforations (eg, post-endoscopic submucosal dissection) provided that the tissue surrounding the perforation is viable and elastic. Therefore, early clip application is important as devitalized, inflamed, and indurated tissue that results with time delay lessens the chance for effective clip closure.

Several TTS clips are commercially available for use (Figure 3). They differ with regard to maximum jaw span, rotation, and capacity to reopen the clip before deployment (Table). In general, TTS clips can be used to close perforations <2 cm in size, although successful closure of larger, nongaping perforations has been described. Both the operator and assistant should be proficient in the use and handling of a selected clip device. Maneuvers to enhance successful clip application in the esophagus include the following: (1) initiate clip closure in a distal to proximal direction; (2) orient the opened clip and apply gentle suction to invert and approximate the margins of the perforation and to capture more tissue within the opened blades of the clip; and (3) place the clips in a closely stacked, zipper fashion to minimize gaps between the clips and ensure adequate closure (Figure 4 and Video 1) [6].