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Esophageal Perforation: A Rare but Life-Threatening Complication of Esophageal Dilatation

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ABSTRACT

Esophageal perforation is a rare but life-threatening complication of esophageal dilatation. Based on a retrospective review of patients treated in a tertiary center for esophageal perforation, this study focused on perforation following esophageal dilatation. A review of different treatments currently available is also presented.

INTRODUCTION

Esophageal dilatation is the first-line treatment for symptomatic gastroesophageal stenosis. It is a safe treatment that is recommended in most cases of benign esophageal stenosis. Esophageal perforation following dilatation is a rare but life-threatening complication of esophageal dilatation. Here, we performed a retrospective review of patients treated for esophageal perforation in a tertiary thoracic surgery department at Bordeaux University Hospital with a focus on perforation occurring after esophageal dilatation. We also present a review of the relevant literature.

PATIENTS AND METHODS

This study was performed using patient files collected in the Epithor clinical national database. Only patients treated in our department for esophageal perforation between January 2010 and September 2019 were included in the study. Ethics approval for use of this database was obtained from the National Commission for Data Protection (Commission nationale de l'informatique et des libertés, CNIL, approval number: 1576793). All patients admitted to our department provided consent for inclusion in this database that is used for national institutional and individual surgeon accreditation. Therefore, there was no requirement for additional patient consent for this study. Data were added prospectively to the database and more details if needed were obtained from the patient files.

RESULTS

During the study period, 17 patients (9 men and 8 women) with a mean age of 74 years (range 61 – 88) were treated for esophageal perforation in our department. The causes of perforation were spontaneous (also called Boerhaave syndrome) in three cases, foreign body perforation in six cases, and iatrogenic in eight cases (transesophageal echocardiography, n = 3; atrial fibrillation ablation therapy, n = 1; and esophageal dilatation, n = 4). The latter four cases are described below.

All of the 17 patients were cured with the exception of one who died due to multiple organ failure after developing Boerhaave syndrome.

CASE 1

This patient was a 72-year-old man undergoing treatment for primary dissecting esophagitis revealed by dysphagia and weight loss. He had a history of meningitis in childhood, deficiency encephalopathy, cumulative smoking history of 30 pack years, and high blood pressure. He weighed 68 kg and was 1.62 m in height (Body Mass Index [BMI] = 25.91). He had protidemia of 71 g/L. Two stenotic segments were identified 25 and 30 cm from the dental arches.

An endoscopic dilation program was underway with the first two sessions involving balloon dilations performed 5 months and 2 months prior to presentation. Perforation occurred during the third dilation session. Three hours after the third dilation, the patient developed fever at 39°C with chills. Clinical examination identified crackles in the two pulmonary bases, cardiac arrhythmia that had not been present previously, and saturation at 93% on skin oximetry. Thoracoabdominal Computed Tomography (CT) confirmed the diagnostic suspicion of esophageal perforation showing pneumomediastinum associated with right pleurisy. Broad-spectrum antibiotic therapy was instituted and the patient was transferred to our department. The indication for surgery was retained. Preoperatively, exploratory esophageal endoscopy performed with a rigid tube identified an esophageal tear extending over 3 cm located 27 cm from the dental arches.

The surgical intervention was performed by two approaches: right thoracotomy to perform washing, suturing, and burial of the esophageal tear and drainage of the pleural cavity and mediastinum. Laparotomy was performed to perform gastric drainage gastrostomy and jejunostomy for enteral feeding.

The postoperative course was marked by a septic syndrome requiring respiratory assistance for 10 days.

The patient was transferred to a convalescence center after a hospital stay of 15 days in the Intensive Care Unit (ICU) and 15 days in the surgical department.

CASE 2

An 88-year-old man presented with perforation of the esophagus after endoscopic dilation for achalasia of the esophagus. He was in remission from prostatic adenocarcinoma that had been treated 10 years ago, followed by Waldenstrom disease and treatment for high blood pressure. The clinical indicators of achalasia were dysphagia that had appeared more than 3 years previously, regurgitation, and weight loss of 8 kg. He weighed 86 kg and was 1.70 m in height (BMI = 29.8; serum albumin, 41 g/L). Dilation had been carried out with balloon inflation for a sequence of 30 s three times from 8 to 10 PSI.

Immediately on awakening after dilation, the patient presented chest pain and subcutaneous emphysema. A diagnosis of suspected perforation was confirmed by CT. Broad-spectrum antibiotic therapy was initiated and the indication for surgery was retained.

The surgical intervention was performed through the left thoracotomy approach and consisted of mediastinal and pleural lavage, suture of the esophageal tear, esophageal myotomy on the opposite circumference of the tear, and reversal plasty of the large gastric tuberosity on the area of the esophageal suture (Dor's fundoplication).

Esophageal healing was favorable without fistula. The postoperative course was marked by a segmental pulmonary embolism. The total period of hospitalization was 40 days, after which the patient was transferred to a rehabilitation center.

CASE 3

A 73-year-old woman was treated in a regional hospital for severe esophageal stenosis associated with chest pain. Esophageal manometry identified severe motor disorders suggestive of scleroderma, although the diagnosis was not confirmed. The patient was undergoing endoscopic treatment. Perforation occurred during the second dilation session, and was quickly diagnosed at the end of the procedure. The patient was then transferred to our department. She had body weight of 58 kg and height of 1.64 m (BMI = 21.6). The surgical procedure was performed via the left thoracotomy approach to perform pleural and mediastinal lavage, followed by suturing of the esophageal tear and drainage. Esophagography on postoperative day 7 showed a small drained esophageal leak that necessitated delaying of oral feeding until it had healed. However, the persistence of dysphagia and chest pain far from the perforation finally led to esophageal resection, which was performed 3 years later.

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CASE 4

A 71-year-old woman suffered from achalasia and was treated by dilation 2 years before the date of perforation. A new program of dilation was proposed due to recurrence of symptoms. Dysphagia was responsible for weight loss of 9 kg in 2 months and was associated with iron deficiency anemia. She weighed 53 kg and was 1.60 m in height (BMI = 20.7). A new dilation was carried out using the same technique as in the previous session using a balloon.

Immediately on awakening after the procedure, she presented manifestations of perforation by chest pain, which was confirmed by CT. Medical treatment was initially proposed (exclusively parenteral nutrition, broad spectrum antibiotic therapy and intensive care surveillance).

On the fourth day of medical treatment, as all clinical (fever, dyspnea) and biological (CRP 236 and GB 15600) criteria showed deterioration and radiological (CT) evolution was observed, surgical treatment was planned.

The surgical treatment consisted of pleural and mediastinal lavage, followed by suturing and burial of the esophageal tear. The postoperative course was uneventful.

COMMENT

In our series, 47% of esophageal perforations had iatrogenic causes and half (23%) occurred following esophageal dilatation. Perforation was less common following dilatation of benign strictures (1.1% with a mortality rate of 0.5%) than following dilatation and/or intubation of malignant strictures (6.4% with a mortality rate of 2.3%) [1].

Hagel et al., [2] reported the most recent large retrospective case series of 1497 procedures in 368 patients over a 10-year period. Operations were performed using Savary-Gilliard dilators (Cook Medical, Bloomington, IN) or Through-The-Scope (TTS) balloons (Controlled Radial Expansion, CRE; Boston Scientific Ltd., Cork, Ireland and Eclipse Wire-Guided Balloon Dilators, Cook Ireland Ltd., Limerick, Ireland). Eight perforations (0.53%) occurred in malignant, postradiation, or caustic strictures. No perforations were reported in other types of strictures, such as cases of peptic, postoperative, and eosinophilic esophagitis [1].

Pneumatic dilation for achalasia seems to have the greatest risk of complications during dilation: complication rate of 1.6% – 6% for achalasia vs. 0.09% – 2.2% for all other causes of benign stenosis [3].

Self-dilation is an alternative that is rarely used for caustic stenosis [4]. Perforation rates of 3.4% after dilation for caustic stenosis and 1.1% after endoscopic resection of strictures have been reported (“).

One of the main prognostic factors reported in most series of esophageal perforation is the delay between diagnosis and treatment regardless of the method applied [5]. A long delay increases the risk of chemical or infectious mediastinitis due to spillage of food and gastric juice (amylase and hydrochloric acid gastric content) into the tissue surrounding the esophagus. All of these conditions occur in Boerhaave syndrome.

Conversely, the prognosis of esophageal perforation after esophageal dilation is good as the diagnosis is more often prompt and it occurs in fasting patients.

The main factor underlying this good prognosis may be that health workers are aware of the risk of esophageal perforation after dilatation, and know that it should be verified before commencing oral feeding. In our department, water-soluble X-ray contrast swallow is routinely performed after dilation of esophageal stricture following esophageal resection before allowing oral feeding. It is also mandatory that the patient be provided information on risk.

Clinical signs depend on the localization of the esophageal tear. Cervical perforation may cause neck pain, dysphonia, upper dysphagia, and subcutaneous emphysema, while systemic symptoms are less common. Thoracic perforation may cause chest pain and dyspnea, and could lead quickly to mediastinitis. Perforation of the gastroesophageal junction frequently causes acute epigastric or abdominal pain and can lead to peritonitis. It is necessary to check for subcutaneous emphysema, which is characterized by crepitation in the neck or at the chest wall during palpation. The systemic signs (tachycardia, fever) usually appear within 24 – 48 hours. Mediastinitis may cause cardiopulmonary collapse and multiple organ failure with a fatal outcome within a short time.

The triad of vomiting, chest pain, and subcutaneous emphysema is known as the Mackler triad and is a specific finding of Boerhaave syndrome.

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Thoracoabdominal CT with water-soluble contrast ingestion is the most accurate assessment and should be performed in suspected cases of esophageal perforation (Figures 1,2,3).

Figure 1: Esophagograph showing esophageal leak in the left pleural cavity.

Figure 2 and 3: CT scans showing pneumomediastinum around the megaesophagus.

With regard to the technique used for dilation, the degree of risk is lower for experienced endoscopists [6]. A retrospective study compared Maloney, balloon-type (both hydrostatic and pneumatic types), and Savary-Gilliard dilators in 102, 156, and 90 sessions, respectively. The risk of eosophageal perforation was higher with Maloney dilators when passed blindly into complex strictures. Therefore, they should be avoided in such cases and in patients with a tortuous esophagus or a large hiatus hernia [1].

The reported risk of perforation in achalasia varies widely across studies from 0% to 8% (2% – 4% in most studies) with mortality rates of 0% – 1%. Katzkaet al. [5] pooled data from 25 studies in the literature and reported a perforation rate of 2%. However, the balloon size, pressure, dilatation times, and single or multiple dilatations varied between these studies. The perforation rate is lower with a graded approach to balloon dilatation and in experienced hands [1].

If the perforation is diagnosed during dilation, many options are available beginning with endoscopic techniques, and may involve the use of clips, stents, or sponges [6,7].

ENDOSCOPIC CLIPS

Endoscopic clips are preferred over stents for cases in which the leak is located in the proximal or the distalmost esophagus [8], and the application of endoscopic clips should be performed early after detection of perforation during the 24 hours [9] before retraction of the mucosa has occurred. Moreover, joining of mucosal tears is not possible in scarred or inflammatory tissue, which forms late after perforation or after previous unsuccessful attempts [10]. The esophagus needs to be clean with little or no passage of its contents into the mediastinum. The technique cannot be performed in unstable patients [7]. Two main types of clips are currently available: TTS clips can only be used for tears < 1 cm because of their small span, they close only the superficial layers; they do not provide full-thickness closure, and they are weaker than Over-The-Scope (OTS) clips. OTS clips can be used for tears of up to 2 – 3 cm [11]. However, OTS clips require endoscope removal if reloading of a clip is needed. The larger diameter of OTS clips can cause iatrogenic perforation during the insertion of a clip-loaded endoscope. The use of OTS is not recommended in cases with a narrow esophageal lumen. To increase the success

of clip treatment, mucosal resection before tissue apposition should be performed before clip placement [12].

ESOPHAGEAL STENTS

Several types of stents are available, i.e., Partially Covered Self-Expandable Metal Stents (PC-SEMSs), Fully Covered Self-Expandable Metal Stents (FC-SEMSs), Self-Expandable Plastic Stents (SEPSs), and biodegradable stents [8]. Stents are commonly used for perforations > 2 cm that cannot be treated with clips. Stents are often used in cases of esophageal malignancy and show good results for perforation or dysphagia; however, surgical resection is the best choice in cases of localized resectable esophageal tumors [13]. Use of stents can be associated with complications, including migration, pain, fever, bleeding, perforation, tumor ingrowth, stent occlusion, and esophageal fistula development [14]. Migration is the most frequent complication, which can be prevented by placing an endoscopic clip at the proximal end of the stent on the mucosa or by endoscopic suturing [15].

ENDOSCOPIC VACUUM SPONGE THERAPY

Endoscopic vacuum sponge therapy is used for drainage and healing of esophageal perforation or anastomotic insufficiency. Suction and drainage can help in sepsis control and for healing of the defect. Endoscopic vacuum therapy involves a sponge attached to the tip of a nasogastric tube that is placed on the site of perforation under endoscopic guidance, which is connected to a suction pump with negative pressure applied to drain the secretions. Although attractive in principle, there have been few clinical reports regarding the use of this method.

If endoscopic techniques are not available, non-operative conservative treatment or surgical treatment may be performed according to the size of the esophageal tear, presence of mediastinal or pleural effusion, the underlying esophageal disease (benign or malignant), and the general condition of the patient. In cases of localized malignant esophageal tumor, esophageal resection should be applied promptly if allowed by the patient's general condition. In cases of unresectable esophageal tumors, the choice is placement of an esophageal stent with associated pleural drainage if necessary.

CONSERVATIVE NON-OPERATIVE TREATMENT

Conservative non-operative treatment should be applied with supervision in the ICU and surgical department by experts in esophageal treatment. Thoracoabdominal CT is mandatory before deciding on this treatment, using the criteria first published by Altorjayet al. [16] (Table 1).

Table 1: Criteria for nonoperative management of esophageal perforation (Altorjay (16)).

1) Intramural perforation
2) Transmural perforation:
1. Perforation detected early, or, when detected late, a circumscribed perforation.
2. A lesion in the mediastinum, or in the space between the mediastinum and visceral pleura causes well encapsulated extravasation.
3. The contrast medium flows adequately from the cavity surrounding the esophagus back into the esophageal lumen.
4. The tissue defect is not in neoplastic tissue, not in the abdominal cavity and is not accompanied by simultaneous obstructive esophageal disease.
5. Symptoms are minimal.
6. Symptoms and signs of septicemia are absent.
7. Availability of adequate techniques: swallowing radiological examination around the clock, eventually CT
8. Adequate thoracic surgical experience and skills.

In all cases, nil per mouth, intravenous fluids, oxygen saturation, and vital constants should be monitored, and appropriate pain treatment and Proton Pump Inhibitors (PPIs) should be initiated. Broad-spectrum antibiotics should be given intravenously to cover both aerobic and anaerobic bacteria. Enteral access for early nutritional support should be considered. Otherwise, surgical treatment is mandatory in cases in which the esophageal tear is large and also after failed conservative non-operative treatment or failed endoscopic treatment.

SURGICAL TREATMENT

There are four objectives when performing surgical conservative treatment of esophageal perforation: clean spillage in the mediastinum and pleural cavity, close the esophageal tear, restore luminal integrity, and prevent persistent leak by drainage [5].

The surgical approach mainly depends on the location of the injury and the side of pleural effusion, and may involve a minimally invasive technique or standard approach [17].

After mediastinal and pleural lavage, the mucosal tear must be well localized. If needed, sectioning of the muscular plan must be done to expose the entire mucosal tear. Then, suturing of the tear in two layers is done with buttressing by a viable flap from the pleura, intercostal pedicle, or by fundoplication. For achalasia, after suturing the tear, myotomy should be performed on the side opposite the tear [18]. In all cases without malignant tumors, conservative esophageal treatment avoiding esophageal resection is always possible [4]. Drainage of the pleural space and placement of a drain near the sutured tear prevent persistent leakage. In cases of inflammatory tissue that is impossible to suture, the Abbott technique using a T-tube may be a useful alternative. Esophageal resection is justified in cases of neoplasia or expanded sclerotic stenosis, such as after caustic burn injury.

In conclusion, perforation after esophageal dilatation is a rare complication and the main prognostic criterion is prompt diagnosis. Many treatment options are available, most of which avoid esophageal resection for non-malignant esophageal disease. Esophageal resection is justified for localized resectable esophageal malignant tumors.

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