Original Paper

Temporary Exclusion of the Perforated Esophagus Using a Linear Vascular Stapler: A New Surgical Treatment

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Abstract

Background/Aims: *A new technique using a linear staple suture for temporary exclusion of the perforated esophagus is presented.*

Materials and Methods: *The procedure is combined with diversion of esophageal fluid by nasogastric tube and drainage of the periesophageal compartments by silicon drains. A gastrostomy is used to drain the stomach for 48 hours, and later for enteral nutrition. Since the suture line reopens spontaneously after approximately 10 days there is no need of reoperation.*

Results: *This method allows diversion of esophageal fluids and therefore enhances effective healing of esophageal perforations after primary repair. Complete spontaneous recanalization of the esophagus occurs approximately two weeks after operation.*

Conclusions: *The combination of primary repair of an esophageal perforation with esophageal exclusion by using a linear stapler and diversion of esophageal fluid contents by naso-esophageal tube and gastrostomy is a simple effective procedure. Further experience and studies may be needed to verify the usefulness and place of this technique in armamentarium of the visceral surgeon.*

Key words: Esophageal perforation - Boerhaave syndrome - surgical treatment - temporary exclusion - mediastinitis

Introduction

The first patient with spontaneous barogenic rupture of the esophagus was described in 1724 by Boerhaave (1). However, over 200 years elapsed before Barret (2) performed a successful primary closure of an esophageal rupture through a thoracotomy. Today, perforations of the esophagus still represent a life-threatening condition that demands early diagnosis and treatment. The overall mortality rate is 20-68% (3-8), largely due to delay in diagnosis, and is related to septic shock from mediastinal infection, resulting in multiple organ failure (7,9). Critically important prognostic factors are delay in diagnosis (10-14), anatomic location (cervical versus intrathoracal) (12), rupture cause and size (13), and finally patient age and co-morbidity (13). The best treatment of thoracic esophageal perforation seems to be early (within the first 24 hours) primary repair of the leak with adequate drainage of involved compartments and supportive therapy including antibiotics and hyperalimentation (13-15). Different treatment techniques have been described to approach the problem of esophageal perforation: conservative treatment with drainage alone (12,13,16,17), esophageal repair with or without gastric fundal patch (18) or pedicled pleural flap (12), gastric patch with fundoplication (18), temporary exclusion and diversion (12,13,18-20), and even total esophagectomy with secondary interposition procedures (7,18,21). All current surgical techniques require a subsequent reconstructive procedure to restore the esophageal transit.

Linear esophageal stapling using absorbable staples has been described as an alternative method for excluding the esophagus without reoperation (19). We report two cases, in which esophageal exclusion was performed using a stainless steel linear stapler (TA Premium 55-3.5 stapler®, Auto Suture AG, Hori, Switzerland). This method achieves complete spontaneous esophageal recanalization after approximately two weeks.

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Patients and methods

Patient 1

A 83-year-old woman was admitted to our department after iatrogenic perforation of the mid esophagus. The perforation occurred 24 hours earlier during endoscopic removal of an impacted meat bolus in the esophagus. The endoscopic treatment was followed by a pain attack in the upper thoracic aperture and consecutive dyspnea. On admission the patient was in poor general condition with blood oxygenation of only 40%. Plain chest X-Ray showed a pneumothorax and pneumomediastinum. The esophageal leak was confirmed by a water soluble contrast medium swallow study (Amidotrizoat, Natrium (Gastrographin®), Schering AG, Zürich, Switzerland). Contrast medium flowing into the left pleural cavity proved the leak. Operation was performed immediately. Because of the bad general condition of the patient, we decided to perform esophageal exclusion and diversion without primary repair of the leak. Cervical esophageal exclusion was performed. After longitudinal myotomy, a linear staple suture line (TA Premium 55-3.5 stapler®) was applied including only the mucosa. This was combined with an esophagostomy proximal to the staple suture. A gastrostomy and feeding jejunostomy were performed and the left pleural cavity was drained with a silicon tube. Prompt clinical improvement was noted under antibiotic supportive therapy within the first days. Spontaneous esophageal recanalization of the staple suture line was documented with gastrografin® swallow two weeks after operation at which time enteral feeding was recommenced. No leakage or stricture were found in the further follow up course. Three weeks after operation the patient was free of symptoms and discharged. The follow up was uneventful at 20 months.

Patient 2

A 68-year old man with chronic alcohol consumption complained of attacks of epigastric pain for two weeks. He was admitted because of exacerbation of these pains. During physical examination, forceful vomiting with hematemesis occurred. Endoscopy was performed immediately. It showed a 2cm longitudinal perforation in the distal esophagus. The esophageal leak was confirmed by a gastrografinR swallow study (**Figure 1**) and computer tomography, showing the typical extra luminal air and esophageal wall thickening. Laparotomy with primary repair was possible after dissection of the esophageal hiatus within the crura. A direct repair with double layer technique and 4/0 NovafilR was done. To prevent a leak and soilage of the periesophageal tissue by saliva, temporary exclusion of the esophagus was performed by a linear staple suture (TA Premium 55-3.5 staplerR) proximal to the repair (**Figure 2**). Diversion was done by a naso-esophageal tube proximal and a gastrostomy (witzel fistula) distal to the repair, both under continuous aspiration. Finally the mediastinum was drained by a Jackson-pratR suction tube (**Figure 2**).

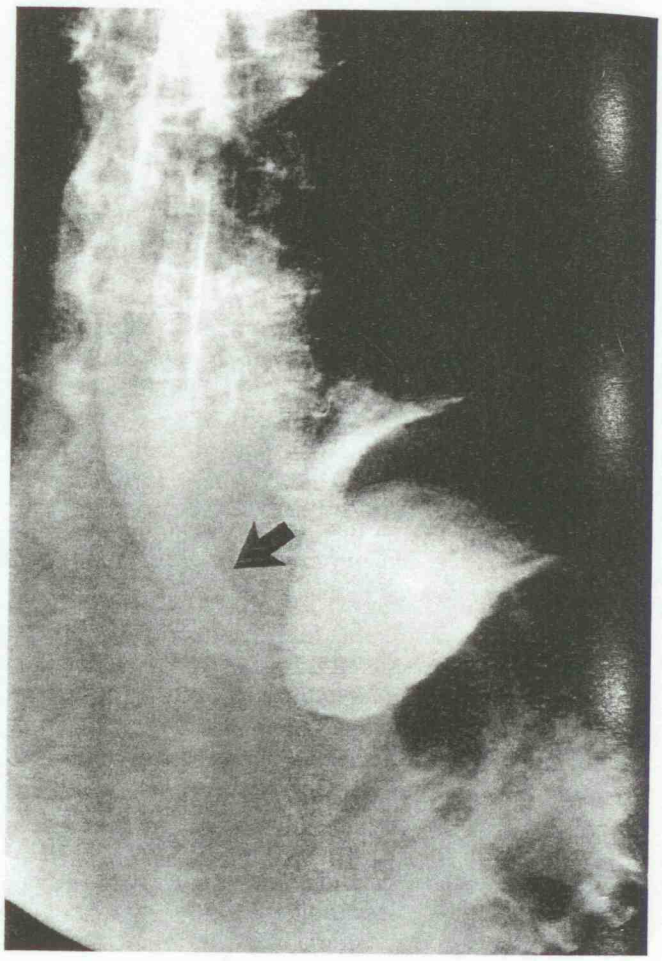

Figure 1 *Gastrografin swallow study in patient Nr. 2 with Boerhaave syndrome. Distal esophageal leak with extravasation of the contrast material into the mediastinum (black closed arrow).*

In this case too, spontaneous esophageal recanalization was documented 14 days after operation by gastrografinR swallow study (**Figure 3**). Two weeks after operation the patient started to eat and was discharged the following week, free of symptoms. The follow up was uneventful at 12 months without clinical sign of esophageal stricture.

Discussion

Esophageal perforation remains a difficult diagnostic and management problem. The treatment techniques are controversial. The most common cause of perforation of the esophagus is instrumentation in esophagoscopy and dilatation for esophageal stricture (52-68%), followed by barogenic trauma or Boerhaave syndrome (13-15%), external trauma (8-15%) and ingested foreign bodies (10-11%) (4,12,14). Boerhaave

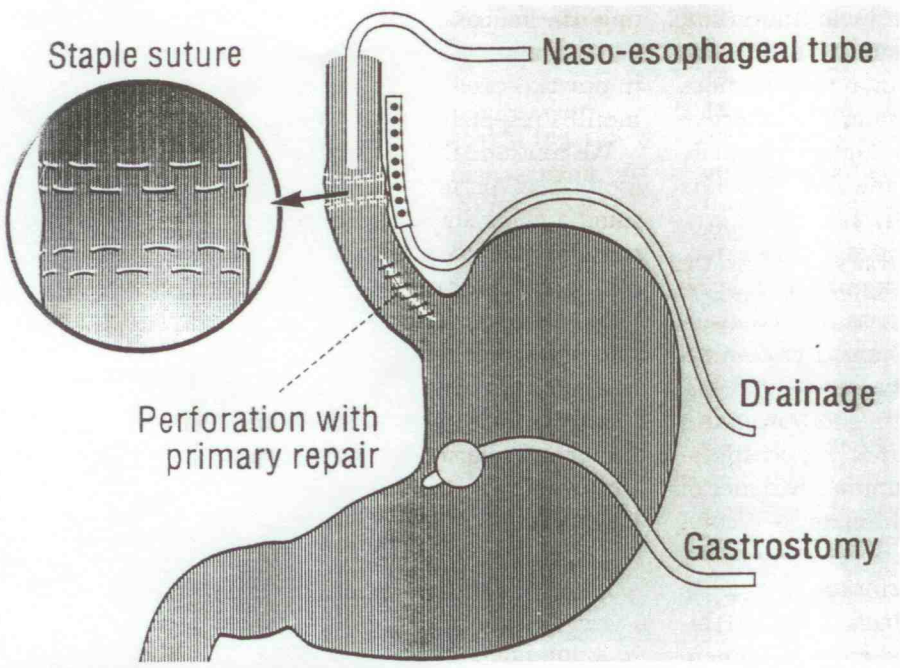

Figure 2 *Postoperative schematic drawing with exclusion of the distal esophagus by a linear staple suture proximal of the primary repair. Diversion by naso-esophageal tube and gastrostomy. Drainage of the mediastinum by a silicon suction tube.*

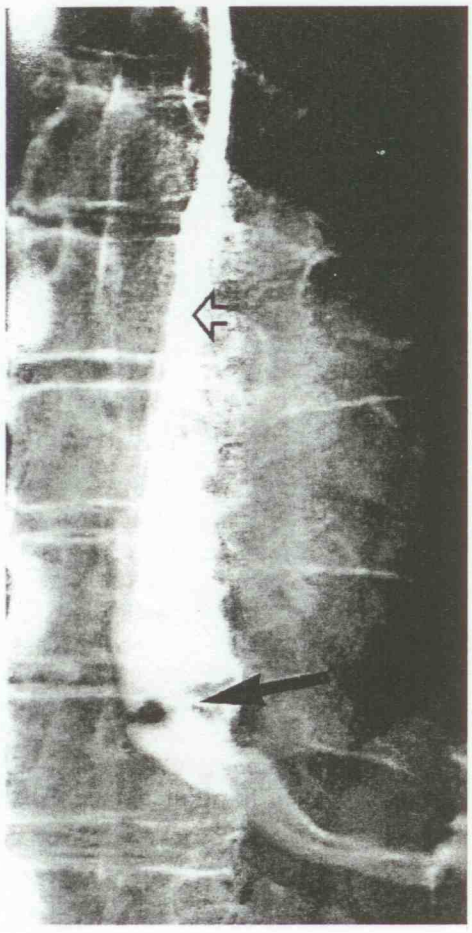

Figure 3 *Gastrografin tubogramm (black open arrow) in the same patient as in Figure 1 two weeks after operation showing spontaneous recanalization of the distal esophagus (black closed arrow).*

syndrome is caused by a strong rise in intra-abdominal pressure (forceful vomiting) which is transmitted against a closed glottis with consecutive rise in the esophageal intraluminal pressure followed by rupture of the distal esophagus in most cases.

The distribution of symptoms and signs varies depending on the location of rupture (12). In cervical esophageal perforation, subcutaneous emphysema, pneumomediastinum and hydrothorax are predominant. However, in thoracic esophageal perforations, hydrothorax, dyspnea with respiratory failure and septic shock are seen most often. Almost all patients with esophageal perforation complain of thoracic or epigastric pain. Fever and leukocytosis are commonly found (12). Diagnosis is based on the suspicion by the treating physician. Upright plain chest radiography may reveal pneumoperitoneum, mediastinal emphysema or hydrothorax. Definitive diagnosis is made by water soluble contrast medium (Gastrografin®) swallow examination with extravasation of the contrast material into the mediastinum. In 85-90% of all cases with esophageal perforation, the swallow study confirms diagnosis (12,13). If no leakage of contrast medium occurs and an esophageal perforation is highly suspected by clinical findings, computer tomography should be done to define the extra luminal manifestation of esophageal rupture like extra esophageal air in most cases (22).

Diagnostic delay has been shown to be an important prognostic factor determining the outcome of the disease. Any thoracic esophageal perforation treated more than 24 hours after the onset of symptoms, irrespective of the procedure, has a significantly higher mortality rate than if it is operated on within the first 24 hours (28% versus 11% mortality rate) (10-14). Boerhaave syndrome is associated with a higher mortality rate too, compared with other causes of perforation. This may be due to difficulty in diagnosis with an associated diagnostic delay in these patients (12,13) and the co-morbidity in most cases of Boerhaave syndrome (13,14). Cervical esophageal perforations have a good prognosis and can be treated conservatively if they are asymptomatic. If they are symptomatic with minimal evidence of clinical sepsis, primary repair with drainage is recommended (14,23). Usually there is no operative mortality in patients with treated cervical perforations (12,13). Perforations of the intrathoracic esophagus can be treated by primary closure and/or exclusion and diversion in early cases, however in delayed cases with mediastinal sepsis primary esophagectomy with secondary reconstruction seems to achieve superior results (7,21). Perforations of the intra-abdominal esophagus should be treated like any other intra-abdominal intestinal perforation by closure and diversion.

The technique of exclusion-diversion in esophageal perforation was first proposed by Johnson in 1956 (24). Subsequently, many attempts have been made to simplify the reconstruction- and/or recanalization interventions with the aim to make a new reoperation unnecessary. The aim of the different techniques of exclusion is to protect the periesophageal tissue against soilage by saliva and gastric contents preventing leakage of the primary repair, which is reported in 25-30% of patients treated by drainage and suture-repair without exclusion (12,25). This susceptibility to leakage of the esophagus after repair can be explained by the fact that the esophagus is the only part of the intestinal tube without a protective serosal coat and it has a critical blood supply (8).

In the past, lower esophageal exclusion with absorbable staples has been advocated for the treatment of Boerhaave syndrome (19,26). Stainless steel staples seemed to be obsolete because of expected persistent closure which requires reoperation (26). Since the clips cut through the mucosa very early, its use for only temporary closure is possible. As our two cases prove, using a stainless steel linear staple line spontaneous recanalization of the esophagus is observed within two weeks after operation, both by suturing only the mucosa or the whole wall of the esophagus. We did not observe leakage or postoperative stricture in our two cases during a follow up time of 12 and 20 months respectively.

We conclude that combination of primary repair of an esophageal perforation with esophageal exclusion by using a linear stapler and diversion of esophageal fluid content by naso-esophageal tube and gastrostomy is a simple and effective procedure in patients with a perforation of the esophagus. Because of spontaneous recanalization two weeks after operation, reoperation is unnecessary. Further experience and studies may be needed to verify the usefulness and place of this new technique in the armamentarium of the visceral surgeon.

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