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Laparoscopic Double-Tract Esophago-Jejunostomy Reconstruction for Iatrogenic Esophageal Perforation After Endoscopic Pneumatic Dilatation for Achalasia: A Case Report

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Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Patient: Male, 73-year-old
Final Diagnosis: Achalasia
Symptoms: Dysphagia
Medication: —
Clinical Procedure: Laparoscopic surgery
Specialty: Surgery

Objective: Unusual setting of medical care

Background: Achalasia is a rare primary esophageal motility disorder of unknown etiology, with significant negative impact on patient quality of life. Esophageal perforation is the most serious complication after pneumatic dilatation for achalasia, with a high mortality rate of up to 20%. Double-tract reconstruction is used mainly after proximal gastrectomy for gastric cancer, with the advantage of functional preservation of the stomach. We report a case of iatrogenic esophageal perforation after endoscopic pneumatic dilatation for achalasia that was successfully managed by laparoscopic proximal gastrectomy with double-tract reconstruction.

Case Report: An elderly man started to manifest desaturation during endoscopic dilatation for achalasia, and multiple esophageal perforations were confirmed just above the gastroesophageal junction. During diagnostic laparoscopy, multiple perforations were found 2 cm proximal to the gastroesophageal junction extending 5 cm proximally with multiple linear mucosal tears. A trial of primary repair was difficult and double-tract reconstruction was performed by transection of the distal esophagus above the perforations and proximal gastrectomy. Then, 3 anastomoses were performed: end-to-end esophago-jejunostomy, end-to-side jejuno-jejunostomy, and side-to-side gastro-jejunostomy 15 cm distal to the esophago-jejunostomy site. After a smooth postoperative course, he was discharged home and was followed up regularly.

Conclusions: Esophageal perforation is the most serious complication after endoscopic pneumatic dilatation for achalasia. Double-tract reconstruction is a feasible and effective reconstruction modality following esophageal resection that avoids complications of esophago-gastrostomy. This technique deserves to be considered a valid treatment modality for advanced and complicated cases of achalasia, but further research is needed.

MeSH Keywords: Endoscopy, Digestive System • Esophageal Achalasia • Esophageal Perforation • Laparoscopy

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Background

Achalasia is a rare primary esophageal motility disorder of unknown etiology, with an estimated annual incidence of 1 in 100 000 individuals [1]. It is characterized by impaired relaxation of the lower esophageal sphincter (LES). It has a significant negative impact on patient quality of life [2].

Currently, achalasia is considered a difficult-to-cure chronic disease, as the available lines of treatment are only symptomatic. The main principle of management is to disrupt the LES impaired relaxation, thus alleviating its functional obstruction and improving food passage. Debate still exists regarding which should be the first line of management: endoscopic pneumatic dilatation, laparoscopic Heller's myotomy, or, recently, the less invasive per-oral endoscopic myotomy (POEM). The choice of surgery is mainly dependent on local guidelines, patient age, and the physician's personal experience [3].

Esophageal perforation is the most serious complication, with differences in reported incidence in the literature ranging from 1% to 4.3% in most series after pneumatic dilatation for achalasia [4]. Esophageal perforation is a potentially life-threatening emergency with a high mortality rate, reaching 20% if not discovered and treated early [5].

Double-tract reconstruction (DTR) is an increasingly used method for restoration of gastrointestinal tract continuity, mainly after proximal gastrectomy for gastric cancer. It has the advantages of functional preservation leading to improved nutrition, prevention of anemia, improved gastric emptying, and easy endoscopic evaluation of the stomach [6].

We report a case of iatrogenic esophageal perforation after endoscopic pneumatic dilatation for achalasia that was successfully managed by laparoscopic proximal gastrectomy with double-tract reconstruction.

Case Report

We present the case of a 73-year-old man who was admitted for endoscopic dilatation for achalasia. His medical history included diabetes mellitus and Parkinsonism. His past surgical history included trans-urethral resection of the prostate (TURP) 1 year ago and laparoscopic cholecystectomy 12 years ago.

Two years ago, he presented to the gastroenterology clinic for dysphagia for solid food. He was diagnosed as having type II achalasia after confirming the condition by manometry and water-soluble studies. A few months ago, he underwent an uneventful endoscopic pneumatic dilatation. He remained free of symptoms for a few months. Thereafter, his symptoms progressively worsened.

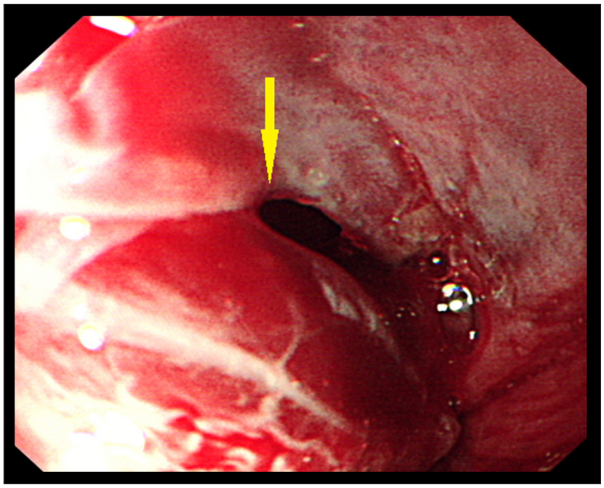

Figure 1. Endoscopic view showing the esophageal tear.

At his latest assessment, he was scheduled for endoscopic pneumatic dilatation. After general anesthesia and endotracheal intubation, he was placed in a left lateral position and a 35-mm Rigiflex dilator was introduced over a guide-wire. The gastroesophageal junction (GEJ) was dilated to 35 mm for 60 s and then again for 90 s. He started to manifest desaturation, and multiple esophageal perforations were confirmed at 10 and 12 o'clock, just above the GEJ (Figure 1). An immediate plain chest radiography showed left-sided pneumothorax and minimal pneumomediastinum because of the multiple esophageal perforations; therefore, a chest tube was inserted on the left side and his oxygen saturation improved. Thoracic and upper gastrointestinal (GI) surgical teams were immediately involved for further management. After discussion, the decision was made to do a diagnostic laparoscopy with a trial of primary esophageal repair.

In the operating room, he was placed in supine position with abducted legs. Pneumatic compression devices and ample padding were used. Preoperative broad-spectrum antibiotics were given. A closed pneumoperitoneum was created via a Veress needle at the Palmer's point and the abdominal pressure was set to 15 mmHg. A 10-mm laparoscope with an angulation of 30 degrees was introduced through an 11-mm optical port, 20 cm below the xiphisternum. Diagnostic laparoscopy showed no free fluid in the abdomen or gross abnormalities. The left lobe of the liver was retracted using a snake retractor. The pars condensa and pars flaccida were dissected after sacrificing the hepatic branch of the vagus nerve using a combination of blunt and sharp dissection performed using a harmonic scalpel.

The esophago-phrenic ligament was dissected and the lower end of the esophagus was mobilized after dissection from the left and right diaphragmatic crura and the mediastinum. Care was taken not to injure the posterior vagus nerve, and

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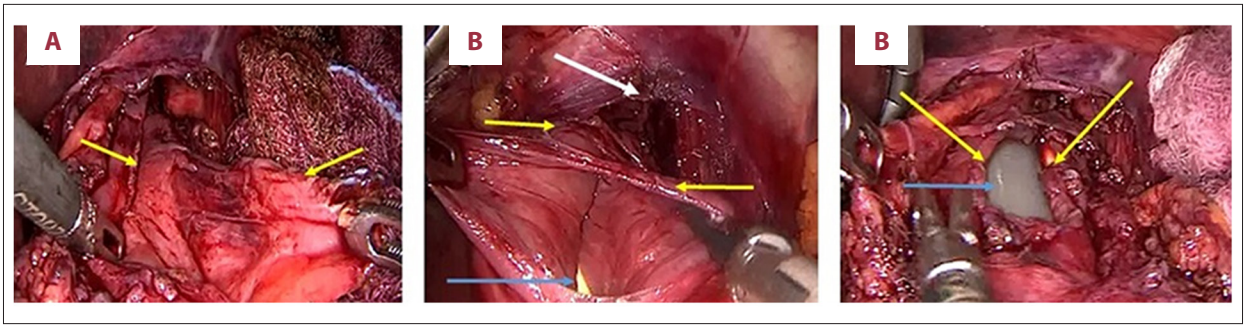

Figure 2. Laparoscopic view showing the esophageal tear. (**A**) The esophageal muscular layers completely teared, held by 2 graspers (yellow arrows). (**B**) The injured esophageal mucosa, the yellow arrows showing multiple tears, the blue arrow showing the tube inside. (**C**) The oro-gastric calibration (blue arrow) tube passing through the esophagus to the stomach.

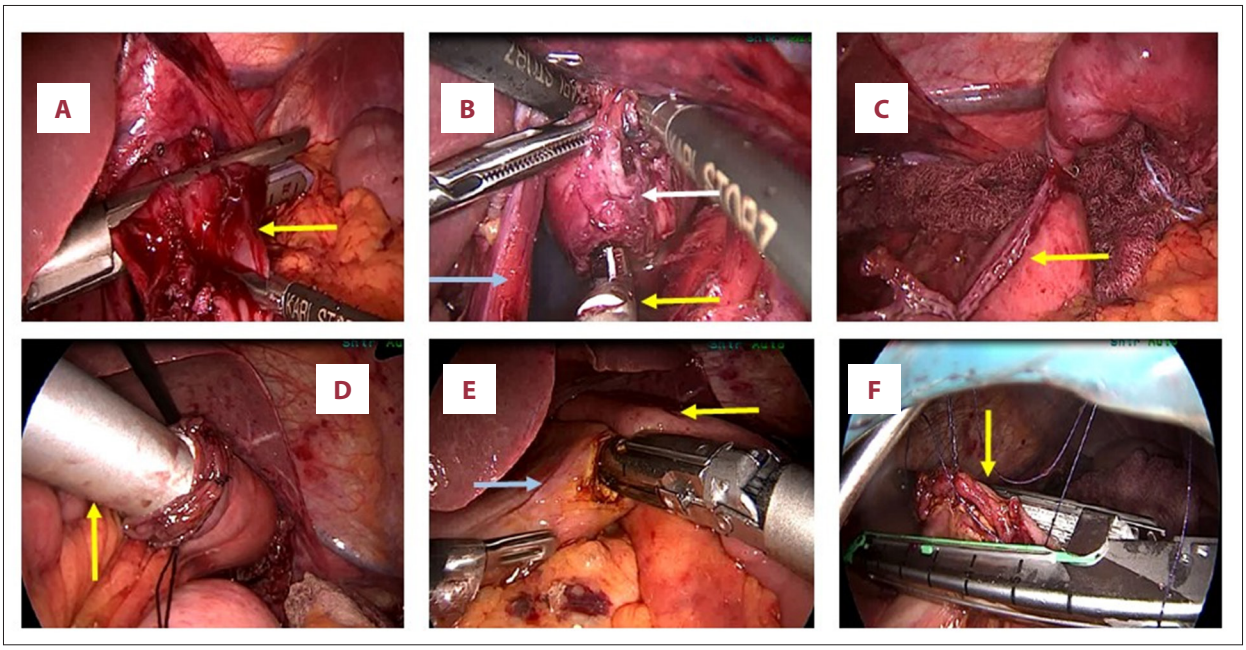

Figure 3. Operative technique used to perform the DTR. (**A**) Transection of the lower end of the esophagus, 8 cm proximal to GEJ. (**B**) Formation of esophagostomy with the help of the Orivel system (yellow arrow), white arrow showing the distal esophagus, blue arrow indicating the left diaphragmatic crus. (**C**) Resection of the proximal part of the stomach (yellow arrow). (**D**). Formation of the first anastomosis: end-to-end esophago-jejunostomy, yellow arrow showing the circular stapler. (**E**) Formation of the second anastomosis: side-to-side gastro-jejunostomy, 15 cm distal to esophago-jejunostomy, yellow arrow showing the jejunal loop, blue arrow showing the stomach. (**F**) Completion of the gastro-jejunostomy.

an umbilical tape was then applied around the GEJ. Multiple perforations were found in the lower esophagus 2 cm proximal to GEJ at 2 and 12 o'clock (opposite to 10 and 12 o'clock in the esophagogastroduodenoscopy), which extended almost 5 cm proximally, with multiple linear mucosal tears (Figure 2).

A trial of primary esophageal repair was attempted. The esophageal mucosa was dissected from the musculosa layer using blunt dissection and the harmonic scalpel. Unfortunately, the mucosa showed multiple linear tears with unhealthy edges, which rendered the repair impractical. After another discussion with the thoracic surgical team, the gastroenterology team, and the anesthesia team, the decision was made to perform double-tract reconstruction to avoid the lengthy thoracotomy procedure, which was not suitable for the patient's age, altered general condition, and comorbidities.

The distal esophagus was transected above the perforated area in a healthy area almost 8 cm above the GEJ using a linear Endo-GIA tri-stapler (Figure 3). Using the Orivel® system, the anvil was introduced through the oral cavity to the distal end of the esophagus. An esophagostomy was created posteriorly using the harmonic scalpel with further introduction of the anvil. A proximal gastrectomy was done transversely using

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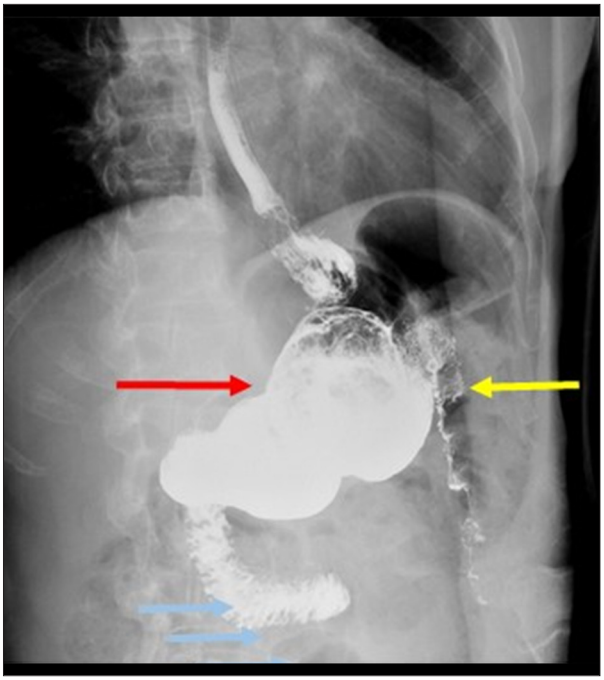

Figure 4. Postoperative oral contrast study showing passage of the oral contrast through 2 tracts: to the stomach (red arrow) and to the jejunum (yellow arrow).

the linear Endo-GIA tri-stapler after mobilization of the fundus with sharp dissection of the greater and lesser curvatures using the harmonic scalpel. The jejunal loop measured 60 cm from the duodeno-jejunal junction. The camera port was extended upward to create a mini-midline incision almost 3 cm in length to facilitate the insertion of the Alexis® port. The jejunal loop was delivered through the Alexis® port and transected to create the alimentary and biliary limbs using the linear Endo-GIA tri-stapler. An end-to-side jejuno-jejunostomy was created using 2 loads of 60 mm purple linear Endo-GIA tri-stapler, and the mesenteric defect was closed. A size 25 circular stapler was introduced through the Alexis® port, then inserted in the alimentary limb and fixed using a silk stay suture. After proper alignment of the anvil and the stapler, the circular stapler was fired and 2 complete doughnuts were removed. Both the gastrostomy and the jejunostomy were created using the harmonic scalpel; however, the later was placed 15 cm distal to esophago-jejunostomy site. A side-to-side gastro-jejunostomy was done using 2 loads of 60-mm green linear Endo-GIA stapler (Figure 3). A size 15 Blake drain was inserted and the patient was transferred, while still intubated, in a stable condition to the surgical Intensive Care Unit (ICU).

The patient was extubated on the first postoperative day and shifted to a regular ward. He was kept on intravenous fluids only and nil per os, and empirical broad-spectrum antibiotics and antifungal drugs were started as well. On the 5th postoperative day, a clear liquid diet was permitted after confirmation of the continuity of the GI tract by a water-soluble study and exclusion of any anastomotic leakage (Figure 4). On the 8th postoperative day, the patient was discharged to his home in a good stable condition and was followed up regularly in the surgery.

Discussion

Achalasia was first described by Thomas Willis in 1674 [7]. Despite the large number of studies that were done on achalasia, its pathophysiology is still unclear. It has been hypothesized that an autoimmune process, triggered by a still unidentified cause, results in neuronal damage in the form of selective loss of inhibitory motor neurons in the myenteric plexus, resulting in an unopposed excitatory neurotransmission after exposure of genetically predisposed subjects to chronic inflammatory processes [8,9].

Endoscopic pneumatic dilatation remains the first line of management, especially in elderly patients, owing to its cost-effectiveness and results comparable to those of laparoscopic Heller's myotomy [4]. Esophageal perforation, after pneumatic dilatation, is a devastating complication with a high mortality rate. Its risk factors include old age, malnutrition, long duration of symptoms, high pressure of the dilating balloon, and repeated dilatations [4].

Mortality and morbidity rates after esophageal perforation are affected by multiple factors, including the etiology, the site of perforation, the timing of management, and the surgical approach. Brinster et al. reported doubling of the mortality rate in cases with delayed management for more than 24 h (27% versus 14%) [10]. Similarly, Biancari et al. reported a mortality rate of 7.4% for immediate management (within 24 h) compared to 20.3% for delayed management [11].

Surgical management for esophageal perforation is the criterion standard and should be considered in all patients, with no consensus regarding the best approach. It includes drainage of any collection, followed by primary repair, delayed repair with esophageal diversion, or esophageal resection with restoration of gastrointestinal continuity using esophago-gastrostomy or Roux-en-Y esophago-jejunostomy. Esophageal resection, using either the abdominal or thoracic approaches, is recommended if the patient has an underlying esophageal malignancy or stricture and in cases of motility disorders such as achalasia, because the underlying disease will hinder the healing process of the repair [10,12]. Non-operative management, including endoscopic stenting, may help if the patient shows no signs of sepsis [4].

DTR, first described by Aikou et al. in 1988 [13], was designed to allow a better esophageal emptying of larger food quantities

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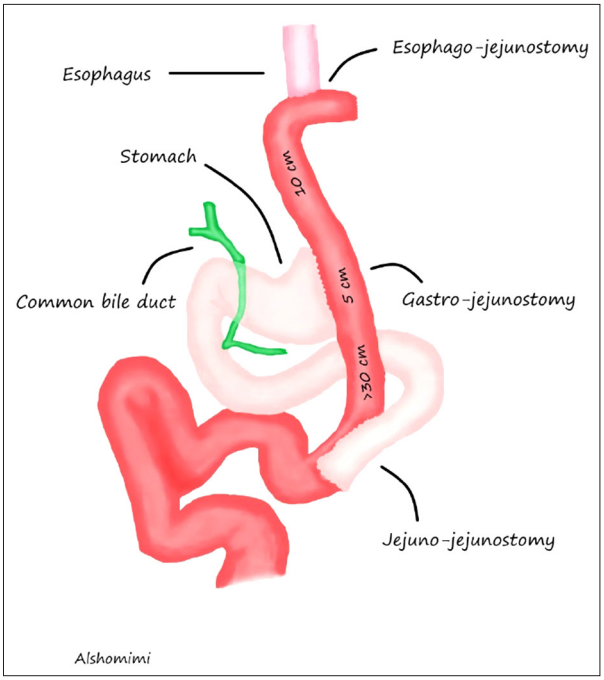

Figure 5. Diagram of double-tract esophago-jejunostomy showing the 3 anastomoses: end-to-end esophago-jejunostomy, end-to-side jejuno-jejunostomy, and side-to-side gastro-jejunostomy.

through the gastric route and to overcome the usual complications after Roux-en-Y esophago-jejunostomy, including reflux esophagitis and malnutrition. This technique is used mainly after proximal gastrectomy for cancer (Figure 5). To the best of our knowledge and after a thorough literature review, this is the first case report discussing the use of the DTR technique to repair an iatrogenic esophageal perforation after pneumatic dilatation for achalasia.

Several advantages have been reported supporting the use of this technique, because after DTR food has 2 pathways, the jejunal limb and the gastric limb, and passing the chymus through the duodenum will reduce the incidence of postoperative cholelithiasis and iron and vitamin B12 malabsorption. Moreover, DTR decreases the incidence of dumping syndrome postoperatively by allowing 2 pathways for food, thus splitting the transit. Additionally, there is an improvement in the quality of life following DTR due to preservation of the food storage capacity of the stomach. Finally, endoscopic evaluation of the stomach is an additional advantage after DTR [14].

DTR consists of end-to-end esophago-jejunostomy, end-to-side jejuno-jejunostomy, and side-to-side gastro-jejunostomy. The length of the interposed jejunum is not fixed. Ahn et al. performed the gastro-jejunostomy 10 cm distal to the site of the esophago-jejunostomy, while this was 15 cm in Nomura's study [15,16].

In our case, some of the risk factors for esophageal perforation were present: the patient was elderly with long duration of symptoms, and the esophageal perforation occurred during the second session of pneumatic dilatation. We first attempted a laparoscopic approach to primarily repair the esophagus, but failed. Other reconstruction methods were not suitable for this particular patient, including the thoracotomy approach or abdominal approach with esophago-gastrostomy and esophago-jejunostomy. The surgical teams, in addition to the anesthesia and gastroenterology teams, preferred to avoid the thoracotomy approach owing to the patient's general condition and hemodynamic instability, which might be worsened by the lengthy thoracotomy procedure. Also, esophago-gastrostomy was technically difficult because the esophagus was transected 8 cm above the hiatus in addition to the presence of some adhesions around the lower part of the stomach. The reconstruction was done using the DTR technique to avoid potential complications following Roux-en-Y esophago-jejunostomy. The total length of the jejunal loop was 60 cm, with the gastro-jejunostomy performed 15 cm distal to the esophago-jejunostomy. After 18 months of follow-up, the patient is maintaining good nutritional status, with no dysphagia or reflux symptoms.

Conclusions

Esophageal perforation is the most serious complication after endoscopic pneumatic dilatation for achalasia. Double-tract reconstruction is a feasible and effective reconstruction modality following esophageal resection because it avoids complications of esophago-gastrostomy. Based on our literature review, we believe this is the first reported case of perforated esophagus after pneumatic dilatation for achalasia that was treated successfully using the DTR technique. In our opinion, this technique deserves to be considered a valid treatment modality for use in advanced and complicated cases of achalasia, but further research is required.

Conflict of interest

None.

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