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Endoscopic Sponge Vacuum Therapy for Large Infected Esophagus Pleural Fistula

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Abstract

A 50-year-old man with hypothyroidism was diagnosed with severe pneumonia secondary to the SARS-CoV-2 virus with an HRCT CORAD score of 18/25 in September 2020. From the records, the patient appeared to have developed spontaneous esophageal perforation. In view of his poor general condition, he was treated with endoscopic sponge vacuum therapy (EVT). EVT is a novel approach for treatment for a closed cavity. Also, very few studies exist in the literature in regard to this procedure.

Keywords
- endoscopic vacuum therapy
- esophageal pleural fistula
- endoscopic sponge
- Boerhaave's syndrome

Case Report

Esophagus–pleural fistula is an uncommon condition. Etiology can be iatrogenic such as post-surgical: e.g., pneumonectomy; malignant: malignancy of esophagus or following Boerhaave's syndrome. We present a case of the esophagus–pleural fistula likely following Boerhaave's syndrome in a middle-aged man, which was managed successfully with a novel therapy—endoscopic vacuum therapy.

A 50-year-old man with hypothyroidism was diagnosed with severe pneumonia secondary to the SARS-CoV-2 virus with an HRCT CORAD score of 18/25 in September 2020. He was admitted to the intensive care unit (ICU) in an outside hospital and received treatment with high-flow oxygen, IV steroids, and broad-spectrum IV antibiotics, low-molecular-weight heparin, and enteral feeding. Limited details were available of the course of events in the outside facility. From the records, he appeared to have developed a spontaneous esophageal perforation (Boerhaave's Syndrome). Computed tomography (CT) chest showed a right-sided empyema (►**Fig. 1A**) and endoscopy revealed a "large defect" in the distal esophagus. An intercostal drainage tube (ICD) was inserted in the empyema and a surgical feeding jejunostomy was performed. During the hospital course, he was transferred to the ICU for the management of septic shock secondary to the empyema and was treated with broad-spectrum antibiotics and low-dose vasopressors for 4 weeks. The patient was eventually transferred to our hospital for further management as per the request of the family.

On admission to our ICU, he appeared cachectic and had lost 15 kg of body weight. Vitals showed tachycardia (110/min) with hypotension (90/60 mm Hg) requiring 8 mL/min of noradrenaline (8 mg in 100 mL of normal saline) to maintain blood pressure. On examination, there was reduced air entry on the right side of his lower chest. Blood investigation showed anemia (Hb 7.8 g/dL), neutrophilic leukocytosis (20,000/mL, 90% neutrophils) and hypoprotenemia (total protein/albumin 5.9/3.1 g/dL). The rest of the laboratories with kidney and liver functions tests were normal. Blood culture and ICD pus culture showed *Proteus mirabilis* and *Klebsiella pneumoniae*,

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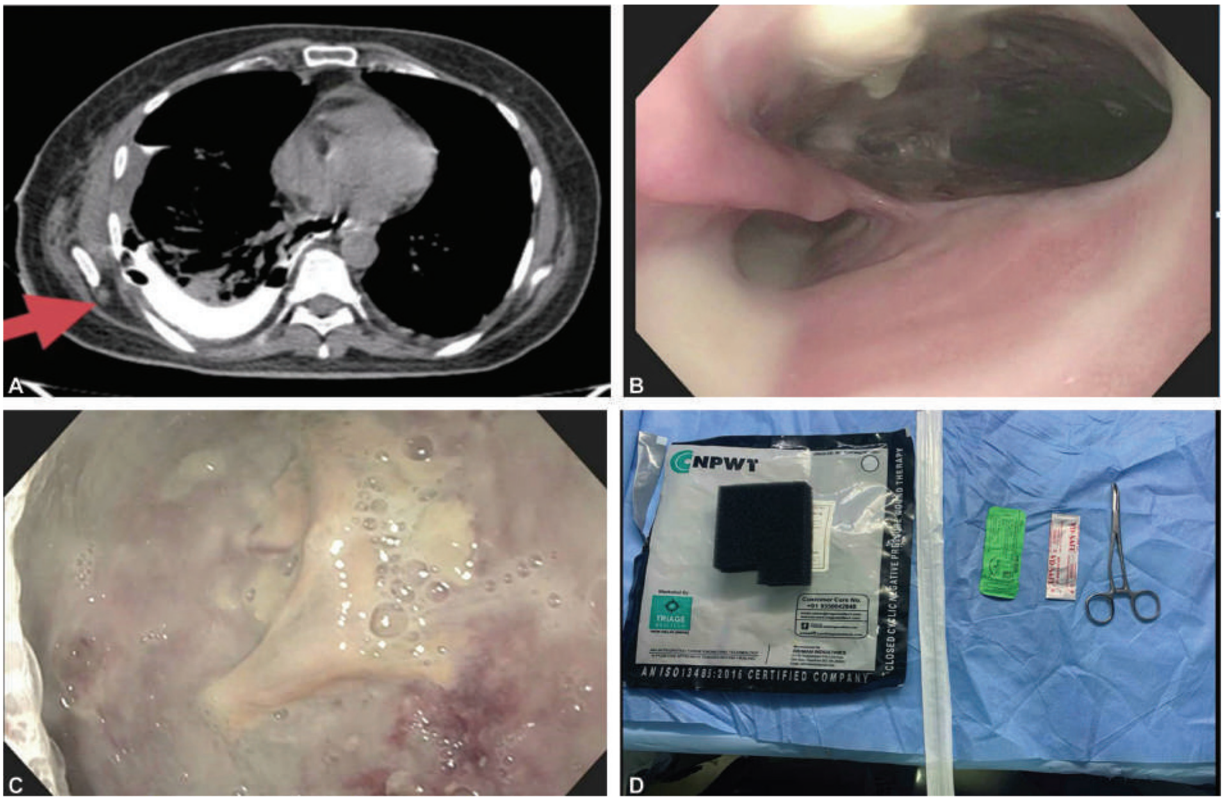

Fig. 1 (**A**) CECT chest showing contrast leak from the esophagus and right-sided empyema. (**B**) UGI endoscopy showing a large esophageal pleural fistula. (**C**) Pus along with debris within the cavity. (**D**) Wound vacuum sponge, 16 Fr tube prolene 2.0 sutures, and artery forceps.

respectively. He was treated with broad-spectrum IV antibiotics to cover the identified organisms based on culture sensitivity reports. Upper GI endoscopy showed a large esophagopleural fistula at 30 cm from incisors measuring $\sim 2.5 \times 5$ cm in size (opening from the esophagus) and a large cavity with pus and debris (►**Fig. 1B, C**). Biopsy from the fistula wall showed non-specific inflammation.

Various options for the management were discussed with the patient and family. Given the size of the defect with a copious amount of pus and debris, with no improvement on ICD and broad-spectrum antibiotics, a decision to perform endoscopic vacuum therapy (EVT) for the management of the fistula was made. For this purpose, a specially designed sponge Endo-SPONGE (Braun), available in Europe, but not in India is used. An "Endosponge" for the purpose of EVT was created using locally available accessories. ►**Fig. 1D** shows the required devices for making an Endosponge—a wound vac polyurethane sponge (CCNPWT Triage; Meditech) an artery forceps, a 16 Fr. Tube (Romsons Ryles Tube Romolene), a prolene 2.0 non-absorbable suture. First, the polyurethane sponge was cut to match the size of the fistula cavity. Next, a blunt hole was made in the sponge using artery forceps. A 16-Fr tube was then inserted across the sponge. The sponge was then sutured to the tube using multiple non-absorbable sutures (Prolene 2.0). The size of the sponge used was progressively reduced based on the decrease in the cavity volume.

Placing a large endosponge across the upper esophageal sphincter (UES) was challenging. To facilitate this, an esophageal overtube (Guardus, Steris) was advanced across the UES using an upper endoscope. Following placement of the overtube, the stylet was removed and the "EndoSponge" was advanced into the distal esophagus (►**Fig. 2A**). This was challenging and required pushing the sponge with the overtube stylet, artery forceps, and endoscope tip to eventually get the large endosponge in the distal esophagus. Next, the endoscope was advanced and the connecting tube grasped with rat tooth forceps and the sponge was guided into the cavity. The scope was then removed gently with clockwise and counter-clockwise torque to prevent dislodgement of the sponge from the cavity. The tube was then re-routed from the nostrils and attached to a vacuum therapy device, which provided a continuous negative pressure of 125 mm Hg. A significant amount of pus was seen coming through the tube. Initially, due to the negative pressure at endosponge plus negative suction of ICD, the patient developed significant chest pain post-procedure. We stopped negative pressure on the chest tube and the pain subsided a few hours later. The ICD eventually fell out and we decided not to reinsert it again. Almost 100 mL of pus was seen accumulating in the suction container daily. The patient remained in ICU for 2 more weeks. He had a persistent fever initially and this gradually subsided. The vasopressors were tapered off over 7 days. Weekly sponge exchanges were performed. Two weeks post-procedure, the cavity was looking much cleaner with an approximation of edges of the cavity (►**Fig. 3A**). In such cavities, the tract tends to epithelialize and

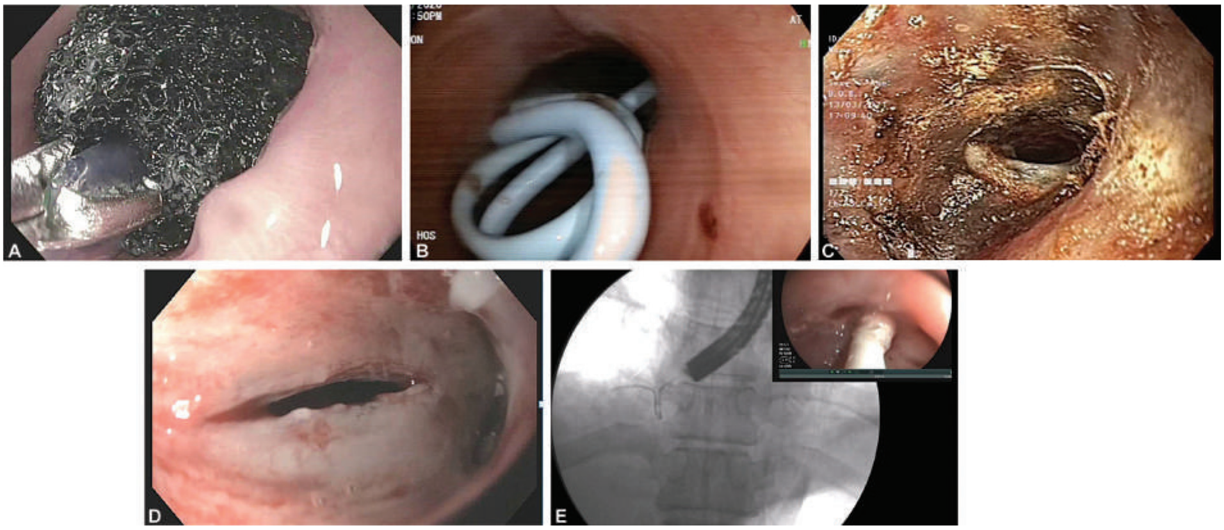

Fig. 2 (**A**) Endosponge placed in the cavity with the help of artery forceps. (**B**) Double pigtails plastic stents are placed into the cavity. (**C**) APC done into the cavity. (**D**) A mucosal tear within the cavity. (**E**) Fluoroscopic view of biodegradable anal fistula plug placement.

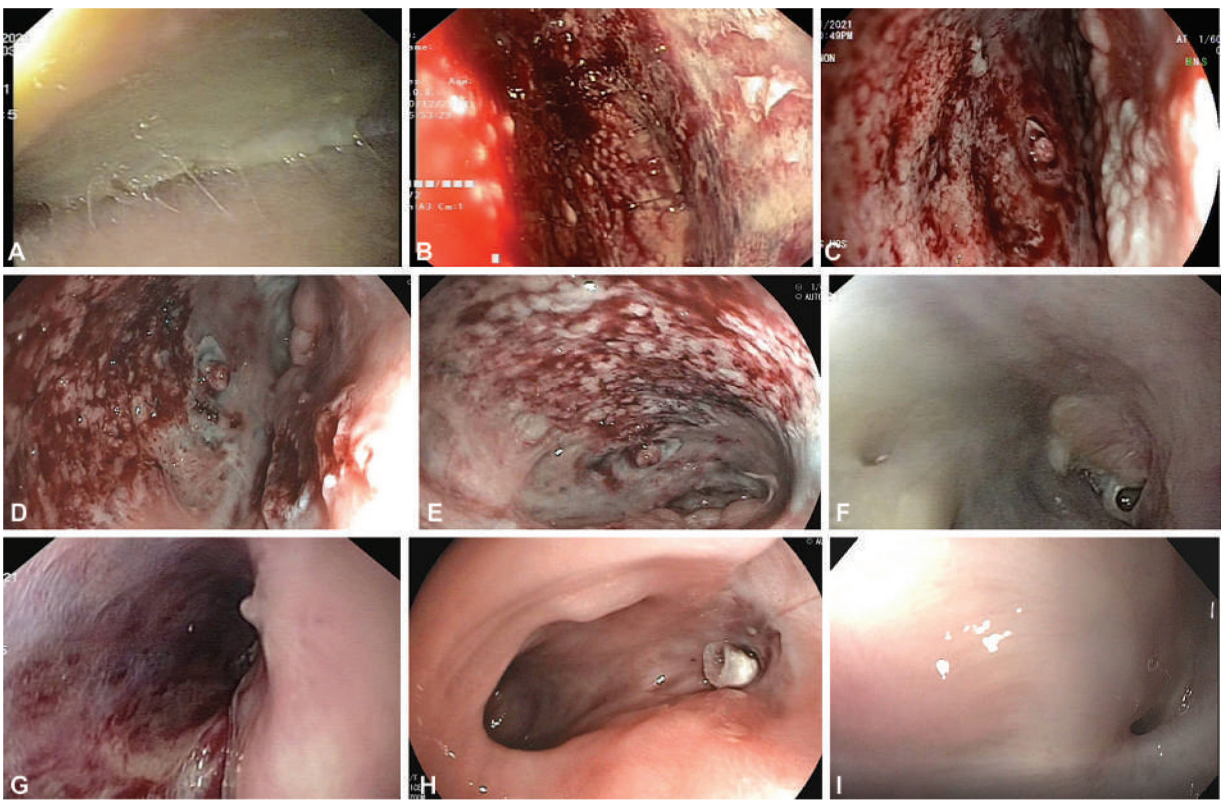

Fig. 3 (**A-I**) Sequential endoscopic images of the esophageal pleural cavity. (**A**) 2 weeks. (**B**) 6 weeks. (**C**) 11 weeks. (**D**) 12 weeks. (**E**) 18 weeks. (**F**) 20 weeks. (**G**) 22 weeks. (**H**) 24 weeks. (**I**) 26 weeks.

membranes begin to form over the surface of the cavity. Adequate debridement of the cavity wall is essential to stimulate the formation of granulation tissue. During the sponge exchanges, various instruments were used to perform mechanical debridement of the cavity wall such as brush cytology and rat tooth forceps. Six weeks later, the cavity showed further improvement (►**Fig. 3B**). To further stimulate closure, in addition to the EndoSponge, we also placed three 10-Fr double pigtail plastic stents beside the endosponge (►**Fig. 2B**). This was performed twice but because the pigtails kept getting dislodged and the patient experienced some discomfort from their placement, we decided not to place them in other sessions. The patient continued to show steady clinical improvement and was eventually discharged 5 weeks after the index procedure. Weekly sponge exchanges with mechanical debridement of

Fig. 4 (**A**) Barium swallow test showing fistula communication of the cavity with the bronchus. (**B**) Barium swallow test showing no leak at 26 weeks.

the cavity wall were performed in the outpatient setting. There was a gradual reduction in the size of the cavity over the next few weeks (►**Fig. 3A–I**).

At week 17, possible fistulous communication with the airways was seen at the distal end of the cavity. This was confirmed with a barium swallow test (►**Fig. 4A**). Given findings of the suspected esophago-bronchial fistula, various management options were discussed including surgical intervention, but the family requested to continue endoscopic management of the fistula. There was no residual debris and the cavity had significantly reduced in size, preventing placement of an endosponge. Therefore, sponge exchanges were discontinued. Argon plasma coagulation (APC) of the cavity wall (ERBE force 3.0) was performed to facilitate closure (►**Fig. 2C**). At one session of debridement, due to inadvertent advancement of the cytology brush of the cavity membrane, there was a tear in the fibrotic wall of the cavity (►**Fig. 2D**). Aggressive APC of this area was additionally performed to facilitate healing. After a total of three APC sessions, at 22 weeks, the cavity was looking better (►**Fig. 3G**). However, a barium swallow test showed persistent communication with the bronchus. Next, after discussing with the family, a decision to place a biodegradable anal fistula plug (Cook Endoscopy) was made. For placement of the plug, first, a 0.035-inch guidewire (Jag Wire by Boston Scientific) was placed under fluoroscopic guidance across the esophagus–bronchial fistula. Next, a hole was made in the fistula plug using a stylet needle and a plug loaded on the guidewire. The endoscope with a 5-Fr pusher was then backloaded on the guidewire. The endoscope was then advanced into the esophagus and the plug was placed into the fistula cavity with the help of the 5 Fr stent pusher (►**Fig. 2E**). After two additional sessions of fistula plug placement, the cavity finally closed (►**Fig. 3I**). The patient has currently resumed oral feeding without any difficulty (►**Video 1**).

Video 1

Endoscopic sponge treatment. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0041-1741513.

The optimal management of UGI transmural defects remains controversial and often requires an interdisciplinary treatment modality. For primary endoscopic management, self-expanding metallic stent (SEMS) placement is often considered the first-line therapy. However, in the absence of strictures, FC-SEMS is associated with a high migration risk, and the success rate is up to 75%. Recently, several reports have shown successful closure of upper GI leaks/fistulas with endoscopic vacuum therapy.[1,2] In one meta-analysis by Jung et al,[3] the closure rate of transmural UGI defects with EVT was 85%, mortality was 11%, complications were 10%, and post-EVT stricture rate was 14%.

Funding
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Conflict of Interest
None declared.

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