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Successful Use of Endoscopic Vacuum-Assisted Closure for Mediastinal Staple Line Leak after Laparoscopic Collis Gastroplasty and Nissen Fundoplication

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Background	Surgery has traditionally been the most frequently utilized option for repairing esophageal perforations and anastomotic leaks; however, it is associated with significant morbidity and mortality. Alternatives to surgery have been proposed, including esophageal stenting, injection of fibrin glue, and clipping. Stenting is associated with significantly less morbidity than surgery but is leak site-dependent and can lead to stent migration and gastric outlet obstruction. Endoscopic vacuum-assisted closure (EVAC) therapy, a method that uses negative pressure to promote healing, has recently been discussed to treat esophageal injury. This technique has not been discussed as a management option for the mediastinal leak after Collis gastroplasty. We aim to discuss the utility of EVAC therapy in a patient with this specific complication.
Summary	In this report, we discuss the case of a patient who underwent laparoscopic Collis gastroplasty and Nissen fundoplication for a large, type IV hiatal hernia. After surgical management, she developed a proximal staple line leak in her mediastinum, with an initial attempt at stenting. When this failed, she underwent EVAC therapy. This was kept to continuous low wall suction with regular foam exchanges, decreasing the foam size as the perforation site healed. After about 40 days, she experienced successful, imaging-confirmed closure of her leak site.
Conclusion	In conclusion, EVAC therapy is a safe and effective management technique for managing mediastinal staple line leak after laparoscopic Collis gastroplasty.
Key Words	endoluminal vacuum-assisted closure; EVAC; Collis gastroplasty; Nissen fundoplication; esophageal staple leak

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Case Description

The patient is a 72-year-old female with a past medical history significant for gastroesophageal reflux disease, hypertension, obstructive sleep apnea, depression, and antiphospholipid antibody syndrome. She underwent a CT scan for an unrelated issue, revealing a large hiatal hernia with entire stomach above her diaphragm. She later saw a gastroenterologist as her reflux symptoms, which were initially controlled with a proton pump inhibitor, were worsening. She began experiencing associated epigastric pain, chest pressure, and bloating after eating, causing her oral intake to decrease. Esophagogastroduodenoscopy (EGD) and manometry were performed, visualizing the hiatal hernia and long-segment Barrett's esophagus without dysplasia. She had normal esophageal motility but low pressure of her lower esophageal sphincter, consistent with acid reflux and her large hiatal hernia.

After cardiac clearance, she underwent laparoscopic hiatal hernia repair with mesh and Nissen fundoplication. After maximal dissection and mobilization of the esophagus, it was noted that 3 cm of her stomach remained in her chest, necessitating a Collis gastroplasty. Her immediate postoperative course was unremarkable. She was discharged on postoperative day (POD) one after tolerating her liquid diet. The pain was controlled on oral medication, and she was voiding and ambulating without issue.

On POD5, the patient presented to the emergency department with shortness of breath, left upper quadrant abdominal pain, and left-sided chest pain. Her vitals were significant for tachycardia. On physical exam, she was in no distress. Her abdomen was soft with mild distension and left upper quadrant tenderness to palpation, and left lung crackles. Her labs were significant for lactic acidosis and mild leukocytosis. CT revealed a leak at the distal esophagus with mediastinal fluid and gas, pneumomediastinum, and subcutaneous emphysema. She was taken emergently to the operating room for laparoscopic converted to open mediastinal washout, mediastinal drain placement, jejunostomy tube placement, and EGD with stent placement. On intraoperative EGD, a 1 cm linear defect was noted at the proximal staple line of the neoesophagus, with significant mucosal inflammatory changes and shallow ulcerations. A stent was deployed, covering the leak site.

This second postoperative course was complicated by reintubation with respiratory failure, a vasopressor requirement to maintain adequate blood pressures, atrial fibrillation, upper extremity venous thrombosis, and surgical site infection. By POD3, she was extubated and off vasopressors. She eventually required bilateral chest tube placement for pleural effusions and CT-guided mediastinal tube insertion. Repeat CT on POD10 showed continued active esophageal leak with contrast extravasation into the mediastinum. An additional stent was placed, partially telescoping and in tandem with the previous stent, with successful bridging. She later required repositioning of stents for continued extravasation of contrast around them. Repeat imaging eventually displayed that while her pleural effusions and mediastinal fluid collections were improving, the leak was still present, prompting a repeat EGD. This revealed a much larger defect, now approximately three by 3 cm (Figure 1). After collaborating with cardiothoracic surgery, the decision was made to proceed with EVAC therapy.

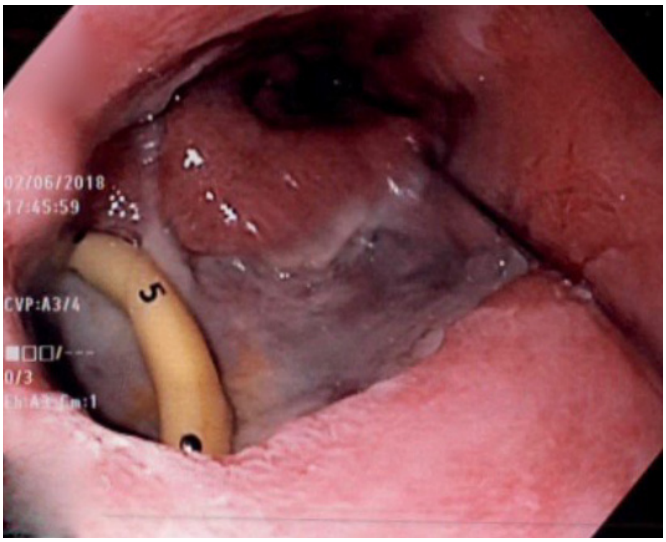

Figure 1. EGD after repeat stent placement showing larger, 3 x 3 cm defect

Her stents were removed, and EVAC therapy was initiated. The technique for EVAC foam placement is described below in the discussion. The foam was placed through the perforation site into the cavity in the left mediastinum. EVAC placement was performed under general anesthesia. She was discharged to an in-house, long-term acute care facility and treatment continued. She underwent foam

exchanges every three days to one week, requiring a total of ten foam exchanges over 41 days, with a progressive decrease in fluid extravasation into the chest and eventual discontinuation of both chest tubes and mediastinal drain. Upper GI at the completion of therapy showed no evidence of a leak (Figure 2). On long-term follow up, her jejunostomy tube had been removed, and she is tolerating a regular diet without dysphagia or reflux.

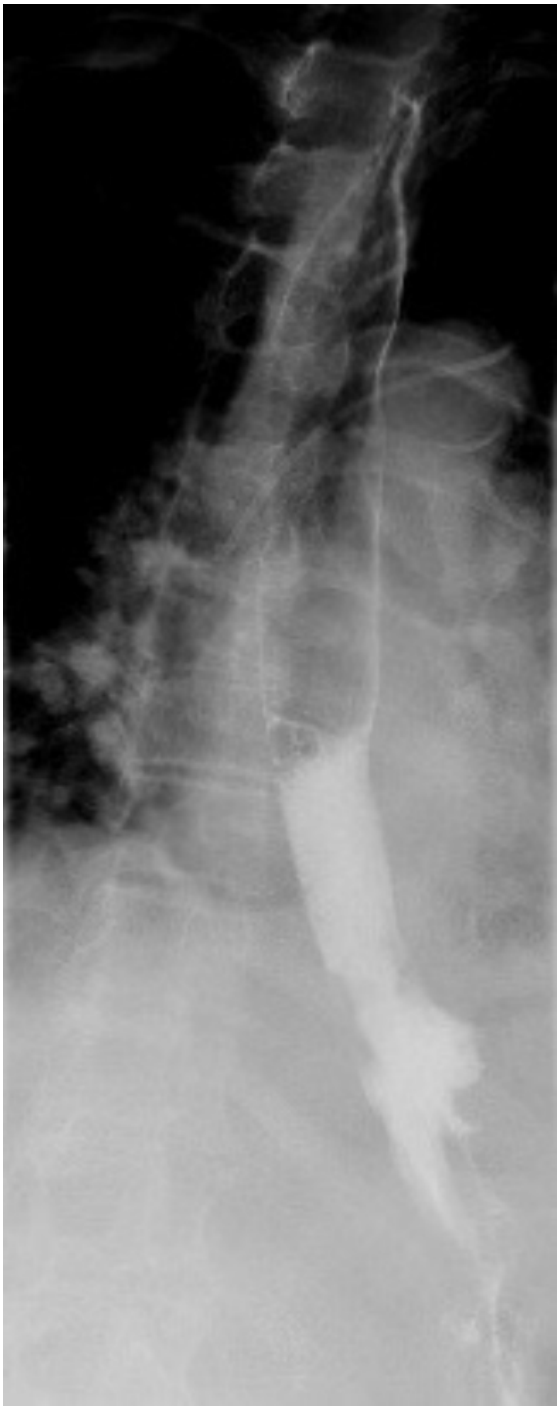

Figure 2. Upper GI with no evidence of leak at completion of therapy

Discussion

Traditionally, surgery has been the most frequently utilized option for repairing esophageal perforations and esophageal anastomotic leaks; however, continued leakage occurs in 30 percent of patients[1] and is associated with high morbidity and mortality.[2] Over the years, varying alternatives to surgery have surfaced regarding management of esophageal and upper gastrointestinal anastomotic leaks. Some include stenting,[1,2] injection of fibrin glue, and clip application.[3] While success rates for stenting have been reported to be above 80 percent,[2] it has been shown to be associated with adverse events such as stent migration and gastric outlet obstruction.[1] In addition, the site of positioning proved to be problematic, sometimes even being a barrier to stenting, secondary to globus sensation,[1,2] vomiting,[1] and even respiratory insufficiency.[2]

EVAC was first described for the treatment of anastomotic leaks after rectal surgery[3] and has subsequently been described for the treatment of esophageal perforations,[3] and anastomotic leaks.[3,4] The benefits of EVAC therapy for esophageal leaks have been discussed in detail, and yet there are no previously published reports of utilizing EVAC therapy for the treatment of mediastinal leak following laparoscopic Collis gastroplasty and Nissen fundoplication.

The technique for EVAC therapy is as follows. After endoscopic evaluation of the perforation site, a standard 16 F nasogastric (NG) tube is advanced through the patient's nostril and pulled out through the mouth. Standard black foam is cut to the size of the defect. The foam is then secured to the end of the NG tube, taking care to ensure all holes of the NG tube are covered by the foam, which may require cutting the NG to a smaller size. The foam is then secured to the NG tube by suturing it to the tube using 2-0 nonabsorbable sutures. An additional suture can be placed through the distal aspect of the foam to use for positioning. A grasper is then placed through the working port of the endoscope and used to grasp the distal aspect of the foam. The NG tube with the secured foam is then advanced into the oropharynx and the esophagus under direct visualization with the endoscope. The foam is then positioned into the perforation site and placed on suction while the endoscope is removed. The NG tube is then secured at the nares with a bridle. The tube is then kept to continuous suction ranging from -80 mmHg to -125 mmHg with foam exchanges every three to seven days until closure is obtained (Figure 3).[2]

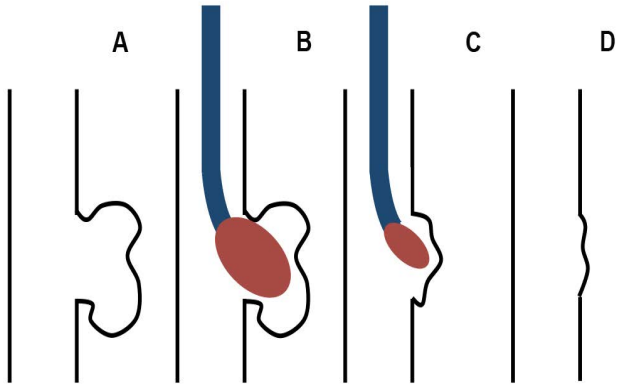

Figure 3. Technique of EVAC: A) esophagus with perforation and leak into the mediastinum; B) EVAC insertion into defect; C) healing defect requiring smaller foam size; D) resolution of defect

EVAC therapy, through the promotion of healing by secondary intention,[4] provides an alternative to surgery and stenting. Using a negative pressure system, EVAC therapy promotes healing through the formation of granulation tissue,[3] rapid removal of infected tissue,[2] reduction in edema,[3] and improvement in blood flow.[3] This concept is similar to wound vacuum therapy for superficial wounds.

The EVAC system has some limitations. While no adverse events were reported in the study by Wedenmeyer et al., patients did experience discomfort secondary to the EVAC system—especially those with an adjuvant duodenal feeding tube, resulting in tubes in both nostrils. In addition, two foam dislocations were seen out of 48 total foam insertions; one was secondary to heavy coughing. Other limitations include the fact that the defect size must be large enough for foam placement; lastly, EVAC therapy can be technically demanding.[3]

Benefits of this system include simplicity of use, few adverse events,[4] and the ability to avoid major morbid operations.[4] A study by Lenzen et al. used EVAC placement for three patients with postoperative cervical esophageal leakage, resulting in complete closure in a median duration of 29 days with a median of seven foam exchanges. In addition, they trended C-reactive protein with a reduction to almost normal levels by discharge.[2] Brangewitz et al. in 2013 compared EVAC therapy with metal stenting for management of esophageal leaks, citing a higher closure rate, lower mortality rate, shorter median treatment, and lower stricture rate.[5] Schniewind et al. found EVAC therapy superior to surgical revision and stent placement regarding mortality.[6] Wedenmeyer et al. studied EVAC therapy for intrathoracic leaks, with the closure of the leak in seven of eight patients. Patients who expired did so from disease recurrence, not from a recurrent leak.[3]

Conclusion

Staple line leak after laparoscopic Collis gastroplasty and Nissen fundoplication is a devastating complication. Surgical repair can lead to continued leakage, and other options such as stenting and fibrin injection can be associated with high morbidity. By increasing blood flow, removing infected tissue, and allowing for healing by secondary intention, EVAC therapy is a promising management strategy that can improve outcomes.

Lessons Learned

EVAC therapy is a safe and effective technique for managing mediastinal staple line leak after laparoscopic Collis gastroplasty and Nissen fundoplication.

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