


## CASE REPORT

## Gastroenterology

# Pulling instead of pushing: A case report of gastrostomy-assisted pull technique as an alternative method for endoluminal sponge placement in EVAC therapy

Carolena Trocchia<sup>1</sup>  | Hester F. Shieh<sup>2</sup> | Isabella Dolan<sup>3</sup> | Michael Wilsey<sup>4</sup> | Charles J. Smithers<sup>2</sup>

<sup>1</sup>Department of Pediatrics, Johns Hopkins All Children's Hospital, Saint Petersburg, Florida, USA

<sup>2</sup>Department of Pediatric Surgery, Johns Hopkins All Children's Hospital, Saint Petersburg, Florida, USA

<sup>3</sup>Denison University, Granville, Ohio, USA

<sup>4</sup>Department of Pediatric Gastroenterology, Johns Hopkins All Children's Hospital, Saint Petersburg, Florida, USA

## Correspondence

Carolena Trocchia, Department of Pediatrics, Johns Hopkins All Children's Hospital, 601 Fifth St South, St. Petersburg, FL 33701-4816, USA.  
Email: [Ctrocch1@jh.edu](mailto:Ctrocch1@jh.edu)

## Funding information

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors

## Abstract

Endoscopic vacuum-assisted therapy offers an easier and safer alternative to thoracic surgery, self-expanding stents, or esophageal clips and has been shown to be a promising technique for management of pediatric esophageal perforations. In this report, we present a novel application of a percutaneous endoscopic gastrostomy-assisted pull technique, wherein a preexisting gastrostomy is reaccessed to allow safe placement of the vacuum sponge with a more comfortable and effective endoscopic vacuum-assisted closure therapy compared to transnasal or transoral options. A 7-year-old male with a history of type C esophageal atresia with distal tracheoesophageal fistula complicated by leak and refractory esophageal stricture, severe tracheomalacia, and prior esophageal stricture resection presented for posterior tracheoplasty and tracheopexy complicated by esophageal perforation. A preexisting gastrostomy site was re-accessed to allow for a novel approach for endoluminal sponge placement in endoscopic vacuum-assisted closure (EVAC) therapy by gastrostomy-assisted pull technique. The patient had appropriate healing without further leak 1 month after repair. This case highlights the use of EVAC as a minimally invasive option for repair of esophageal perforation using a pull-through method at the percutaneous endoscopic gastrostomy tube site as gastric access. This method may improve control of placement and reduce sponge migration, reduce intraluminal distance of sponge placement, and reduce morbidity by avoiding thoracotomy.

## KEYWORDS

endoscopic vacuum therapy, endoscopic vacuum-assisted closure, esophageal atresia, esophageal perforation

## 1 | INTRODUCTION

Esophageal perforation and leaks are acutely dangerous in both adults and children. Potential etiologies may include postoperative complications following

esophageal or airway operations, blunt trauma, nasogastric tube insertion, foreign body ingestion, endotracheal intubation, and endoscopic procedures, with endoscopic instrumentation as the most common cause of pediatric esophageal perforation.<sup>1,2</sup>

Guarantor of the article: Michael Wilsey, MD (NASPGHAN member). Carolena Trocchia, Michael Wilsey and Charles Jason Smithers are co-senior authors on this project.

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2024 The Authors. *JPGN Reports* published by Wiley Periodicals LLC on behalf of The European Society for Pediatric Gastroenterology, Hepatology, and Nutrition and the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition.

Endoscopic vacuum therapy (EVT) is now a standard procedure in adults as a treatment for esophageal perforations as it offers a safer alternative to thoracic surgery, self-expanding stents, or esophageal clips and has shown to be a promising technique for management of pediatric esophageal perforations.<sup>3,4</sup> EVT utilizes negative-pressure wound therapy adapted through use of a sponge for intraluminal perforations by way of an endoscopic vacuum-assisted closure (EVAC).<sup>3</sup> In this report, we present a novel application of a percutaneous endoscopic gastrostomy-assisted pull technique, wherein a pre-existing gastrostomy is re-accessed to allow safe placement of the vacuum sponge with a more comfortable and effective EVAC therapy compared to transnasal or transoral options.

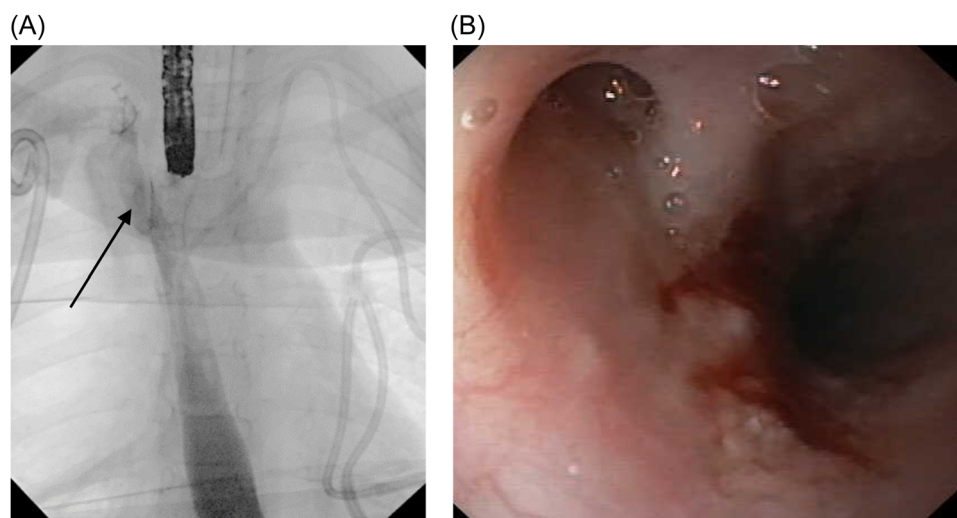
## 2 | CASE REPORT

A 7-year-old male with a history of type C esophageal atresia with distal tracheoesophageal fistula status post repair as a newborn complicated by leak and refractory esophageal stricture, gastrostomy tube dependence, and severe tracheomalacia. He previously underwent esophageal stricture resection with slide esophagoplasty anastomosis, resection of a tracheal diverticulum, and posterior tracheopexy. His anastomotic stricture subsequently resolved after 7 postoperative dilations, and the patient progressed to full oral feeds with gastrostomy removal. Surveillance bronchoscopy demonstrated severe persistent tracheomalacia with wide bow-shaped cartilages, with a worsening trend of respiratory symptoms and chronic cough. Therefore, he underwent a revision

tracheopexy via right neck and chest approach for thoracic membrane reduction tapering tracheoplasty, and cervical posterior tracheopexy. On postoperative Day (POD) 3, he developed respiratory distress with radiographic findings of a new right loculated hydro-pneumothorax. Interventional radiology placed a chest tube with fluid concerning for esophageal perforation, which was confirmed by esophagoscopy and Omnipaque contrast study (Figure 1A) on POD 5. A small esophageal perforation a few centimeters superior to his prior esophageal anastomosis was found, related to retraction injury from the operation, and a nasoesophageal (NE) suction tube was placed to drain the leak.

The patient then returned to surgery for repeat EGD, which demonstrated an ongoing esophageal perforation and leak; therefore, an endoscopic vacuum-assisted device (EVAC) was placed based on a transnasal tube. An endoluminal vacuum was created using a black sponge secured around a 12 French Salem sump nasogastric tube with 0 silk ties so that the sponge covered all suction holes. The sponge was soaked with contrast to view on fluoroscopy to confirm placement. Using laryngoscopy, the EVAC was advanced into position using McGill forceps. Next, the contrast was injected to prove the proper position and function of the vacuum system, and the EVAC was secured with a bridle system on the nasal septum.

Five days later, the patient returned to the operating room for endoscopic evaluation. There was ongoing chest tube drainage, and the EVAC did not appear to function well with minimal output. It appeared that the drainage tube was clogged. The esophageal perforation was still present, and the decision was made to

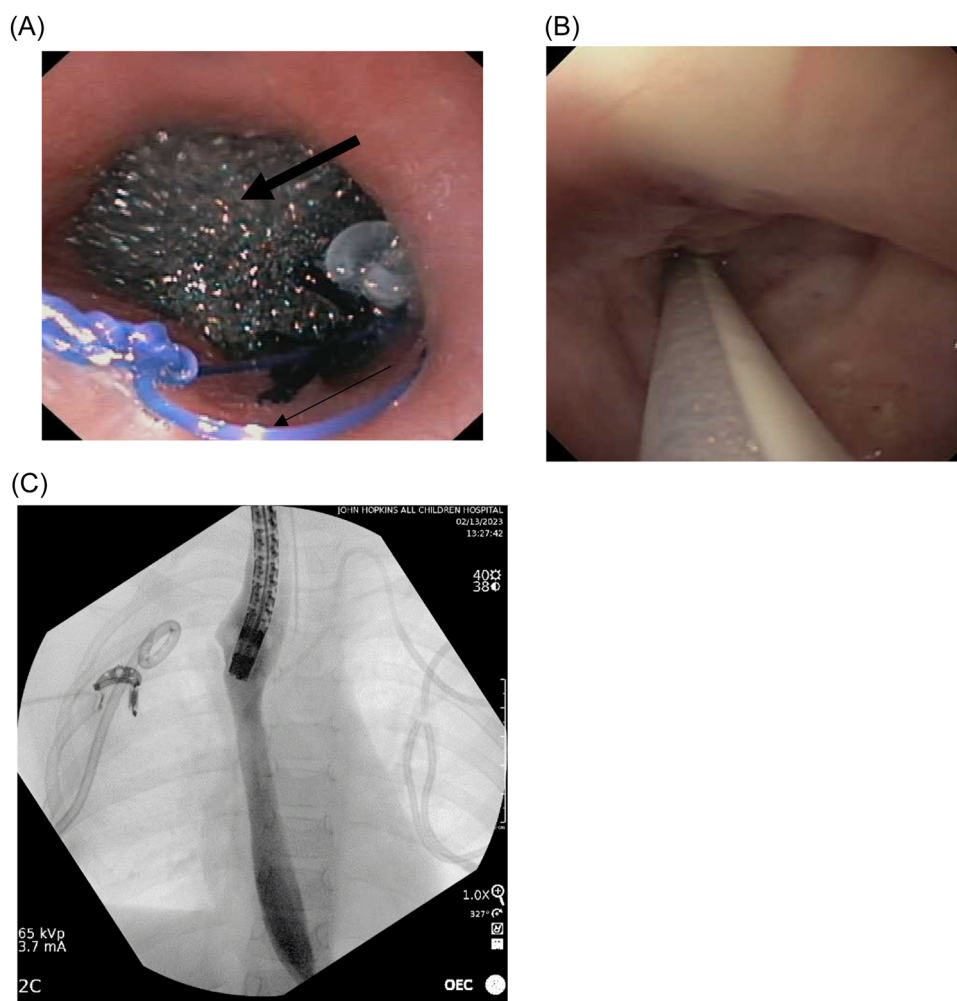


**FIGURE 1** (A) Fluoroscopy demonstrating esophageal perforation by endoscopic Omnipaque contrast injection (arrow). An endoscopic vacuum-assisted closure (EVAC) sponge with a 12-French Salem sump nasogastric tube was subsequently placed in an antegrade fashion using McGill forceps. (B) Esophageal perforation visualized endoscopically after the EVAC was removed after 5 days due to minimal output.

exchange the EVAC for one based on a larger suction tube. However, there was concern this would have been too uncomfortable in a nasal or oral position (Figure 1B). His prior gastrostomy site was re-accessed using the percutaneous endoscopic gastrostomy (PEG) method. A larger endoluminal EVAC sponge was created around a 15 French Jackson Pratt drain and placed with fluoroscopic guidance, which came out of the gastrostomy site instead of the nasal route (Figure 2A). Six days later, the EVAC was removed, and the esophageal perforation was no longer present on contrast injection with fluoroscopy (Figure 2B,C). All esophageal tubes were removed, and the transgastric drainage tube was replaced with a Mickey gastrostomy button. A subsequent esophagram a month later demonstrated no leak or stricture (Figure 3).

### 3 | DISCUSSION

A preexisting gastrostomy site was re-accessed to allow for a novel approach for endoluminal sponge placement in E-VAC therapy by gastrostomy-assisted pull technique. Although primary closure remains standard of care for esophageal perforation, others include medical management, drainage, and many cases can be successfully treated with endoscopic intervention with stent placement.<sup>5-7</sup> EVAC demonstrated greater success in healing surgical anastomotic perforations over stenting and has been used for gastrointestinal leaks, fistulas, and perforations within pediatric patients.<sup>5</sup> EVT functions by connecting a polyurethane sponge or porous film to a suction catheter that is either intraluminally placed via endoscopy, or via intracavitary placement by insertion into



**FIGURE 2** (A) Proximal view of the second endoscopic vacuum-assisted closure (EVAC) sponge pulled into place in a retrograde fashion over the esophageal perforation (thick arrow). The distal aspect of the larger 15-French Jackson Pratt drain exits out of the newly created gastrostomy site. Blue 2-0 Prolene suture tag (thin arrow) is seen on the proximal tip to allow manipulation of the EVAC by the endoscope during placement and removal. (B) Endoscopy view of healed perforation during second EVAC sponge removal six days after placement. This was confirmed fluoroscopically with endoscopic contrast injection intraoperatively (Figure 2C). The 15-French transgastric drainage tubing was removed and replaced with a gastrostomy button under endoscopic visualization. (C) Fluoroscopy with endoscopic contrast injection upon removal of second EVAC sponge showing no further esophageal leak.



**FIGURE 3** Follow-up esophagram 3 days after endoscopic vacuum-assisted closure (EVAC) sponge removal demonstrated healed site of perforation.

the perforation site to cover the region of perforation.<sup>7</sup> This creates negative pressure therapy at the perforation site, causing a collapse of surrounding tissue forming the seal, which stimulates granulation of the wound to promote closure.<sup>7</sup> Beyond wound closure, EVT allows continuous drainage to reduce local edema and promote perfusion while reducing the chance of infection, all of which further its success.<sup>8</sup>

EVAC is a minimally invasive procedure that can be used to treat perforation through placement of a sponge-like material to the affected region and connecting it to a vacuum pump. In this case, gastric access was obtained through PEG to allow sponge placement via the pull-through technique. This method includes a string inserted into the stomach through the abdominal wall that is grasped with an endoscope and pulled out through the mouth to attach to the feeding tube to pull in the reverse direction from mouth to stomach and exiting the abdominal wall.<sup>9</sup>

This option to pull the endoluminal sponge through the gastrostomy may have advantages in improving control of placement, reducing the risk of sponge migration, and avoiding surgical intervention. Depending on the anatomy and exact location of the perforation, it may bypass a segment of esophagus to reduce intraluminal distance of sponge placement. This method may provide easier access and improved patient comfort and tolerance of the EVAC, especially considering patients with difficulty swallowing or significant gag reflex. Therefore, the choice to pull the sponge through the gastrostomy site is dependent on anatomy, provider

comfort, center support, and multidisciplinary expertise. Additionally, patients treated successfully with this technique have reduced morbidity by avoiding repeat thoracotomy.<sup>8</sup>

## 4 | CONCLUSION

This case highlights the use of a PEG tube as gastric access for the management of esophageal perforation with the insertion of an EVAC device by regaining access through a prior gastrostomy site as a potential method to heal esophageal perforation and avoiding thoracotomy. Although many factors impact the ability to perform this procedure, this may be a consideration for patients without prior gastrostomy, perhaps with T-fasteners for the primary PEG and/or laparoscopic-assisted PEG.

## ACKNOWLEDGMENTS

All listed authors received no funding from any source for this project. All authors deny any use of AI-assistance in the writing process of this manuscript.

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

## ETHICS STATEMENT

Informed consent was obtained from the parents to publish the details of this case report.

## ORCID

Carolina Trocchia  <https://orcid.org/0000-0003-0933-5045>

## REFERENCES

- Govindarajan KK. Esophageal perforation in children: etiology and management, with special reference to endoscopic esophageal perforation. *Korean J Pediatr*. 2018;61(6):175-179. doi:10.3345/kjp.2018.61.6.175
- Vieira E, Cabral MJ, Gonçalves M. Esophageal perforation in children: a review of one pediatric surgery institution's experience (16 years). *Acta Med Port*. 2013;26:102-106.
- Manfredi MA, Clark SJ, Staffa SJ, et al. Endoscopic esophageal vacuum therapy: a novel therapy for esophageal perforations in pediatric patients. *J Pediatr Gastroenterol Nutr*. 2018;67(6):706-712. doi:10.1097/MPG.0000000000002073
- Scognamiglio P, Reeh M, Karstens K, et al. Endoscopic vacuum therapy versus stenting for postoperative esophagoenteric anastomotic leakage: systematic review and meta-analysis. *Endoscopy*. 2020;52(8):632-642. doi:10.1055/a-1149-1741
- Paspatis GA, Arvanitakis M, Dumonceau JM, et al. Diagnosis and management of iatrogenic endoscopic perforations: European Society of Gastrointestinal Endoscopy (ESGE) position statement – update 2020. *Endoscopy*. 2020;52:792-810.
- Felmly LM, Kwon H, Denlinger CE, Klapper JA. Esophageal perforation: a common clinical problem with many different management options. *Am Surg*. 2017;83(8):911-917
- Kaczmarek DJ, Heling DJ, Strassburg CP, et al. Management of esophageal perforations in infants by endoscopic vacuum

therapy: a single center case series. *BMC Gastroenterol.* 2022;22(1):282. doi:10.1186/s12876-022-02346-2

8. Stathopoulos P, Zumblick M, Wächter S, et al. Endoscopic vacuum therapy (EVT) for acute esophageal perforation: could it replace surgery? *Endosc Int Open.* 2022;1010(5):E686-E693. doi:10.1055/a-1781-0827
9. Homan M, Hauser B, Romano C, et al. Percutaneous endoscopic gastrostomy in children: an update to the ESPGHAN position paper. *J Pediatr Gastroenterol Nutr.* 2021;73:415-426. doi:10.1097/MPG.0000000000003207

**How to cite this article:** Trocchia C, Shieh HF, Dolan I, Wilsey M, Smithers CJ. Pulling instead of pushing: a case report of gastrostomy-assisted pull technique as an alternative method for endoluminal sponge placement in EVAC therapy. *JPGN Rep.* 2024;5:74-78. doi:10.1002/jpr3.12040