

## CASE REPORT

# Battery swallow-induced tracheoesophageal fistula in a pediatric patient

Lindsey N. Nguyen<sup>1</sup>  | Sathish Ramanathan<sup>2</sup> | Hamid R. Vahabzadeh-Monshie<sup>2</sup> | Jack C. Borders<sup>2</sup> | Alberto J. de Armendi<sup>2</sup> 

<sup>1</sup>University of Oklahoma College of Medicine, Oklahoma City, OK, USA

<sup>2</sup>Departments of Anesthesiology and Otolaryngology, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

## Correspondence

Alberto J. de Armendi, Department of Anesthesiology, University of Oklahoma Health Sciences Center, 920 Stanton L Young Blvd, Suite 1140, Oklahoma City, OK 73104, USA.

Email: Alberto-dearmendi@ouhsc.edu

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## Abstract

Tracheoesophageal fistula (TEF) is an abnormal connection between the trachea and esophagus. Rare acquired TEF arises from trauma, caustic fluids ingestion, and iatrogenic injuries (ventilation, esophageal atresia repair, radiation, or tracheal/esophageal stents). We discuss the diagnosis, anesthetic management, and surgical correction of battery swallow-induced TEF, not previously reported in the pediatric anesthesia and otorhinolaryngology literatures.

## KEYWORDS

airway anomaly, anesthesia, battery, pediatric, tracheoesophageal fistula

## 1 | INTRODUCTION

Etiology of tracheoesophageal fistula is commonly congenital due to failure of proper embryonic lung bud branching, resulting in lateral septation of the foregut into the esophagus and trachea. Clinically, tracheoesophageal fistula (TEF) severity relates to oxygenation and aspiration pneumonia from gastric reflux.

Acquired TEF is rare. Battery ingestion has recently increased in incidence, presenting asymptotically or with nonspecific symptoms of fever, poor feeding, and dyspnea. The battery establishes an electrical circuit within the esophagus producing hydroxide ions at the negative pole forming alkali burns that perforate the esophagus and create a TEF.<sup>1</sup> Treatment of battery swallow-induced TEF requires immediate surgery, preferably within two hours to minimize friability, tissue necrosis, fistula enlargement, tracheobronchial contamination, sepsis, and nutritional problems.<sup>2</sup> We discuss the diagnosis, anesthetic approach,

and surgical corrections of battery swallow-induced TEF (Figure 1) in a pediatric patient.

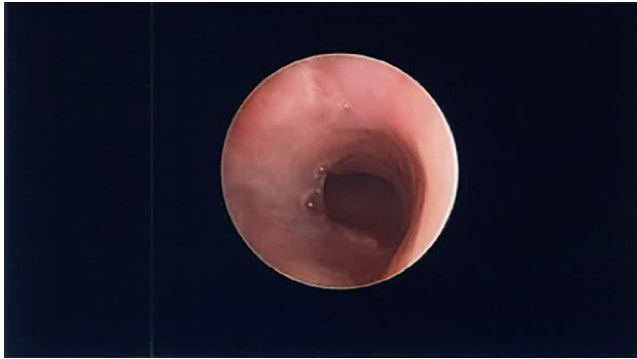
## 2 | CASE REPORT

A 13-month-old patient (8.9 kg) postesophagoscopy and button battery removal presented for surgical repair of 30% complete tracheal erosion from cervical 6-thoracic 1. Past medical history included recent upper respiratory tract infection, resolving viral myocarditis, sick euthyroid syndrome, and salt-wasting syndrome. Preoperatively, the critical airway was at risk for life-threatening tracheal separation, bleeding (if aorto-esophageal fistula formed), and mediastinitis. Physical examination showed stable vital signs with diminished air entry to left lung. Chest X-ray demonstrated right upper lobe atelectasis and left lung base airspace opacity.

Prior to surgery, the otolaryngologist and anesthesiologist met to discuss the surgical and anesthetic plans and blood

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**FIGURE 1** Tracheoesophageal fistula. Tracheal view toward esophagus

was made available from the blood bank for possible aorto-esophageal fistula bleed. The patient arrived to the operating room already intubated with 3.0 cuffed oral endotracheal tube (ETT) located distal to the TEF in stable condition and premedicated with midazolam and fentanyl. General anesthesia was induced with cisatracurium, fentanyl, and propofol. Under direct vision, the otolaryngologist extubated the trachea. Albuterol and epinephrine were administered for bronchodilation. After encountering ventilation difficulty from bloody secretions, a tracheostomy was successfully performed with 3.5 cuffed tracheostomy tube.

Once again, prior to the next planned surgery, the surgeon and anesthesiologist discussed their plans and alerted the blood bank for the possible activation of the massive blood transfusion protocol if an aorto-esophageal fistula bleed was to occur. One week later, the patient underwent direct laryngoscopy/bronchoscopy and TEF repair. Patient arrived in the operating room with a tracheostomy tube in place distal to the TEF repair with midazolam and fentanyl drips. General anesthesia was induced with rocuronium, fentanyl, and propofol. Total intravenous anesthesia was maintained with propofol infusion and fentanyl boluses. The tracheostomy tube was removed, the trachea was intubated orally with ETT advanced beyond the TEF, and TEF was repaired. Upon conclusion of the cervical TEF repair surgery, the patient was awakened and the trachea was extubated uneventfully. Postoperatively, the patient was maintained on total parenteral nutrition through a nasogastric tube. The patient recovered without respiratory or cardiovascular complications.

### 3 | DISCUSSION

Tracheoesophageal fistula is an abnormal communication between trachea and esophagus. A recent common cause of acquired TEF is battery ingestion. Risks involved with TEF surgical ligation are associated with fragile necrotic tissue, including fistula formation, tracheal separation, pneumothorax, pneumomediastinum, esophageal stricture, vocal cord paralysis, thyroid hemorrhage, spine spondylodiscitis, bleeding (if

aorto-esophageal fistula formed), chest infections/sepsis, and death.<sup>3</sup> Anesthetic management challenges are ETT placement failure if TEF size and position are unknown, postoperative airway obstruction, aspiration, and loss of airway from bleeding or difficulty with ETT replacement. Anesthesia safety precautions for battery swallow-induced TEF rely on understanding size and position of the TEF preoperatively.

Early battery removal is essential as severity of damage and complications correlate with duration of battery lodgment in the esophagus.<sup>4</sup> If surgery is not readily available, mitigating efforts to decrease pH at the battery site to a more neutral level include drinking weakly acidic liquid (lemon/orange juice), honey, sucralfate, and dilute acetic acid.<sup>4</sup> Direct laryngoscopy/bronchoscopy should be performed to confirm TEF, followed by surgical repair.<sup>2</sup> Conservative management with temporary endoluminal tracheal or esophageal stents has been implemented to prevent pulmonary contamination.<sup>5</sup> Surgical management of acquired TEF involves single-stage patch repair of the tracheal and esophageal defects with possible partial esophagectomy, cervical esophagostomy, and gastrostomy. Utilization of vascularized local tissue flaps has been recommended to reinforce repair sites. Postoperatively, intravenous antibiotics are administered if concerned for mediastinitis, tracheal stents inserted to retain airway patency, and gastrostomy feeds implemented for nutritional support.<sup>2</sup> Early extubation and avoidance of postsurgical positive-pressure ventilation have been recommended.<sup>5</sup>

The Button Battery Task Force aims to decrease the incidence of battery ingestion in children. Despite concerted efforts from government, industry, academia, medicine, and public health, battery ingestion continues to occur.<sup>4</sup> The National Capital Poison Center (website: <http://www.poisson.org/battery>, accessed 1 April 2020) and National Battery Ingestion Hotline (1-800-498-8666, available 24 hours/7 days a week) guide the public in battery ingestion issues.

In conclusion, we present a life-threatening battery swallow-induced TEF, which required emergent anesthesia for infection drainage, placement of ETT distal to the damage, tracheostomy, and TEF repair. We emphasize preparation, understanding TEF anatomy, and excellent communication among surgeons, radiology, blood bank, and anesthesiologists for the proper care of these pediatric critical airways.

### HUMAN ETHICS APPROVAL DECLARATION

The authors declare human ethics approval was not needed for this study.

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None.

### CONFLICT OF INTEREST

None.

## AUTHOR CONTRIBUTIONS

Lindsey N. Nguyen: wrote and edited the case report. Sathish Ramanathan, Hamid R. Vahabzadeh-Monshie, Jack C. Borders, Alberto J. de Armendi: were clinically involved with the case and edited the case report.

## DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

## ORCID

Lindsey N. Nguyen  <https://orcid.org/0000-0001-8253-3991>

Alberto J. de Armendi  <https://orcid.org/0000-0003-0685-2821>

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