A 2 Years Old Boy with Recurrent Tracheoesophageal Fistula After Surgical Removal of an Esophageal Button Battery

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Patient: Male, 2-year-old
Final Diagnosis: Button battery induced tracheoesophageal fistula and recurrence
Symptoms: Cough • difficulty in swallowing • irritability • lethargy • vomiting
Medication: —
Clinical Procedure: Buttery removal with tracheoesophageal fistula closure through cervical incision • exploration with esophagostomy and gastrostomy • recurrent tracheoesophageal fistula repair and esophageal anastomosis through thoracotomy
Specialty: Otolaryngology • Pediatrics and Neonatology • Surgery

Objective: Unusual clinical course
Background: Among the pediatric population, button batteries ingestion is a significant health risk. The main treatment of ingested esophageal button batteries is urgent endoscopic removal. Missed or delayed diagnosis results in serious complications and outcomes. In the literature, high morbidity and mortality have been described in cases of button battery ingestion. By reporting this case we aim to encourage physicians to raise their suspicion of foreign body ingestion in similar pediatric cases and to review the different management approaches in the case of foreign body-induced tracheoesophageal fistula.

Case Report: A 2-year-old boy was referred to us with difficulty in swallowing solids and liquids, with tactile fever for 1 month. A chest X-ray showed a radiopaque foreign body consistent with a button battery. The battery was removed through surgical cervical incision followed by closure of an identified tracheoesophageal fistula, cervical loop esophagostomy, and gastrostomy. After 6 months of follow-up and gastrostomy feeding, recurrence of the tracheoesophageal fistula was identified, for which surgical closure and esophageal anastomosis were performed. A postoperative esophagogram done on day 7 showed no leak or evidence of tracheoesophageal fistula; the patient started oral feeding and the gastrostomy tube was removed.

Conclusions: Even in the absence of witnessed ingestion, the persistent nonspecific symptoms must raise the suspicion of foreign body ingestion in the pediatric age group. Failure of endoscopic removal of the battery is a possibility that need to be included in management algorithms. Surgical repair is the most frequently described approach for foreign body-induced tracheoesophageal fistula repair.

Keywords: Esophagus • Foreign Bodies • Tracheoesophageal Fistula • Esophagostomy • Esophagoscopy

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/937810
Background

Button battery (BB) ingestion is one of the clinical scenarios seen in the pediatric emergency department and it has a significant health risk for the pediatric population, especially in children younger than 6 years of age [1,2]. Worldwide, BB ingestion account for 7-25% of all foreign body ingestion in children [2]. In recent years, BB ingestion increased secondary to increased use in many household devices such as calculators, wrist watches, control devices, and some children’s toys, resulting in easy access by children [3]. Children with an esophageal impacted button battery sometimes present with a wide variety of nonspecific symptoms such as fever, lethargy, difficulty in breathing, vomiting, refusal of feeding, and drooling of saliva [4]. Hence, 54% of fatal cases and 27% of major complications were delayed and misdiagnosed, as in our case [4,5]. Aortoesophageal fistula or other major arterial branch fistula is the most serious consequence and complication, which can lead to a fatal outcome because of massive hemorrhage [2]. Other major complications include tracheoesophageal fistula (TEF), esophageal perforation, esophageal stricture, vocal cord paralysis, pneumothorax, mediastinitis, and spondylodiscitis [2,5,6].

Here, we report a case of delayed diagnosis of an ingested BB resulting in unsuccessful endoscopic removal, which is a possibility that is not included in the management algorithms for an esophageal BB. Also, we describe our surgical approach for battery removal, which is not frequently reported in the literature, and review the different management approaches in the case of foreign body-induced TEF, which was the major complication in our case.

Case Report

We report the case of a 2-year-old boy who was born preterm (30 weeks) with a low birth weight of 1.2 kg. He stayed in the neonatal intensive care unit (NICU) for 38 days on a mechanical ventilator (MV), and had a previous surgical history of right inguinal hernial repair and circumcision at the age of 10 months. He was referred to us with difficulty in swallowing solids and liquids with tactile fever for 1 month. This was associated with lethargy, irritability, episodes of cough, and vomiting. There was no history of sudden choking or witnessed foreign body ingestion. He was taken to private polyclinics several times over the last 1 month with the same concern and was treated with antipyretic and antibiotics without any improvement in his clinical status. A chest X-ray at the last visit to a private polyclinic showed a foreign body in the upper esophagus at the level of the clavicles. The patient then was referred to a general hospital in which ENT service is available, as it was not available in our hospital at that time. The repeated chest and abdominal X-ray in the receiving general hospital confirmed the diagnosis of esophageal BB at the previously mentioned position. Bronchoscopy and esophagoscopy were performed there and showed mild laryngeal edema and severe esophageal inflammation with massive edema, and neither BB nor tracheoesophageal fistula (TEF) had been visualized in either one. The child was intubated and admitted to the Intensive Care Unit (ICU) before he was referred to us as a children’s specialized hospital.

On examination, he was sedated on mechanical ventilation. He had a FiO2 requirement of 30%, respiratory rate of 25 breaths/min, and oxygen saturation of 99% on MV. His weight was 12 kg (at the 50th percentile on the World Health Organization growth chart). Clinical examination of the chest, cardiovascular, abdominal, and other systems were within normal limits.

Investigation including blood workup revealed mild metabolic acidosis (pH=7.33 CO2=40 HCO3=21.2), microcytic hypochromic anemia with hemoglobin 8.5 g/dL, and normal chemistry and coagulation profile except for hypoalbuminemia (albumin=26.6 g/L). Chest and abdomen X-ray (anteroposterior [AP] and lateral view) revealed a round, radio-opaque foreign body with a halo or double ring sign suggestive of a button (disc) battery (Figure 1).

The first day of admission, he was taken to the operation theater by a gastroenterologist and pediatric surgeon for button battery removal. Flexible esophagoscopy was performed under general anesthesia (GA). Pediatric and neonatal scopes failed to pass beyond 15 cm due to resistance and structure formation. No foreign body was seen, and the scope was taken out. A right cervical incision was established, the esophagus was identified, and esophagotomy was performed, but no battery was seen initially. Then, by using a curved artery forceps and through an audible click, the battery was found impeded and covered by the esophageal mucosa at the retrosternal level. As the battery was removed, a TEF was noticed at the site because of a gush of air after removal of the battery. Three stitches with 3-0 Vicryl suture were used to close the fistula, after which an air leak test was negative. A trial to push a nasogastric tube to the stomach failed because of the esophageal edema, so closure of the esophagotomy and the wound were performed to reduce the edema.

On day 1 after battery removal, he developed subcutaneous emphysema at the neck and limited to the supraclavicular region, raising the suspicion of an esophageal leak rather than fistula closure failure because it was localized emphysema with no ventilatory setting changes. He was taken to the operation theater under GA flexible fiberoptic bronchoscopy done by the thoracic surgeon through the endotracheal tube, which
was then pulled up by the anesthetist to allow visualization of the trachea. The upper tracheal wall was seen sealed with the surgical repair and the distal trachea up to the carina was intact, which exclude the tracheal leak. After bronchoscopy surgical exploration initiated from the same cervical incision, cervical loop esophagostomy and gastrostomy were performed.

Postoperatively, he was kept in the Pediatric Intensive Care Unit (PICU) for 4 days and extubated on postoperative day 2. He was kept nil per os or gastrostomy tube on total parenteral nutrition, and we administered intravenous antibiotics (vancomycin and piperacillin-tazobactam), proton pump inhibitor (omeprazole), and H₂ blocker (Ranitidine). Gastrostomy feeding was started 7 days postoperatively as continuous feeding with gradual escalation over a few days, then shifted to boluses every 3 h. He was discharged home on boluses gastrostomy feeding and proton pump inhibitor with monthly follow-up in the outpatient clinic.

During the monthly follow-up, he was found to have lost weight on multiple occasions, reaching 7.55 kg. Referral for a clinical dietitian was made aiming to improve and maximize his caloric intake, and further surgical intervention was postponed until he had gained enough weight to tolerate the procedure.

At the 6-month follow-up, the father had a concern of infrequent spitting of the gastrostomy feeding content through the mouth, which raised the suspicion of TEF with the lower esophagus. The patient’s weight reached 9.8 kg, so we decided to perform a second-stage operation, no preoperative bronchoscopy. In the operating theater under GA, retroversion endoscopy from the gastrostomy tube was performed and TEF was identified with the lower esophagus. Then, the site of the cervical esophagostomy was dissected and the segment between the esophagostomy site and TEF site was found to be fibrosed and could not be used. Thoracotomy was done by the thoracic surgeon to separate the TEF from the lower esophagus and to mobilize the lower esophagus for performance of esophageal anastomosis without tension. Fistula closure done with 3-0 Vicryl suture, then esophageal anastomosis with 4-0 Vicryl suture, ending with wound closure. No tissue interposition was used because the site of the esophageal anastomosis was far away from the TEF site. Postoperatively, he was kept intubated in the PICU for 2 days, on intravenous antibiotics (clindamycin and piperacillin-tazobactam), proton pump inhibitor (omeprazole), TPN, and nil per os or gastrostomy tube until postoperative day 3, when he was started on minimal gastrostomy feeding. An esophagogram was done 7 days after the second operation, and no esophageal leak or evidence of TEF was found (Figure 2). As the patient started on oral clear liquid, soft then normal diet and tolerating it over 5 days, the gastrostomy tube was removed, and he was discharged home on postoperative day 16.
Discussion

Most ingested foreign bodies and button battery are lodged beneath the cricopharyngeal muscle or at the anatomical areas of esophageal narrowing, including the aortic arch level, left main bronchus level, and lower esophageal sphincter [7,8].

In cases of ingested BB, high morbidity and mortality have been observed and reported among the pediatric age group [6].

Battery-induced local tissue injury and damage result from 4 different mechanisms: direct pressure on adjacent tissue, alkaline leakage, heavy metal toxicity, and, most importantly, electrolytic current that lyses and digests nearby tissue [4,5,9]. The extent of tissue injury and subsequent signs and symptoms are related to the child’s age, battery size, type, voltage, duration of mucosal contact, site of impaction, and presence of previous pathology [7,9].

We report this case of a misdiagnosed BB ingestion secondary to the unwitnessed event and nonspecific patient symptoms resulting in a TEF as a major complication, which was reported in 47.9% of the major outcome cases of button battery ingestion [6]. In such cases with delayed diagnosis of BB, immediate radiologic localization of the battery is important, and a contrast CT study should be performed before battery removal to identify complications and evaluate for vascular injury, which was missed and not performed in our case [2].

For the management of esophageal FB and BB, emergent rigid or flexible endoscopic removal along with an assessment of the esophageal injury, preferably within 2 h of ingestion, is the primary treatment [2,4,6]. Surgical intervention in cases of BB ingestion is mainly reported for the treatment of complications, but in very few cases, where the FB or BB was difficult and failed to be removed endoscopically due to trans-mural impaction or migration as in our case, neck exploration and battery removal through surgical cervical approach were reported as another modality of treatment [1,10]. Lisi et al reported surgical removal of a BB in 2 asymptomatic female patients ages 26 and 29 months, who presented within 4 h of witnessed battery ingestion. Both underwent unsuccessful endoscopic removal of the batteries, which were removed later through a cervical esophagotomy. After battery removal, the first patient developed severe esophageal stenosis, then TEF, which was treated conservatively, followed by esophageal dilatation and stenting. The second patient had an asymptomatic limited esophageal stenosis and did not require any dilatation [10].

A different approach has been reported for esophageal FB-induced tracheoesophageal fistula closure and repair including endoscopic cautery, endoscopic excision, and fibrin glue application, and the most often described is surgical repair [3].

Lao et al reported successful use of subsequent application of electrocautery and fibrin glue as a combined modality in a 33-month-old female with esophageal foreign body-induced tracheoesophageal fistula, where the esophagogram 6 weeks after electrocautery and fibrin glue placement revealed no evidence of tracheoesophageal fistula [1]. In our case, the surgical repair through the cervical esophagotomy approach had been used to repair the first TEF at the time of battery removal, but the thoracotomy approach was used for the second TEF.

Figure 2. Postoperative day 7 esophagogram with no esophageal contrast leak or evidence of TEF.
to provide a wider view and space for the surgical area to allow esophageal mobilization and anastomosis without tension.

Spontaneous closure of FB-induced TEF has been reported in some patients. Grisel et al reported using the conservative approach in managing TEF induced by FB in a 3-year-old child, in which long-term follow-up and multiple repeated esophagogram were done, demonstrating the failure of conservative therapy with evidence of a persistent fistula, which was repaired surgically through the transtracheal approach [11].

Shibuya et al described a successful strategy for the conservative management of TEF in a 16-month-old boy who was having fever, cough, and dysphagia. The diagnosis of upper esophageal BB was made followed by battery removal through the rigid laryngoscope. Eight days after battery removal, TEF was identified by endoscopy and treated conservatively with serial follow-up endoscopies, resulting in spontaneous closure by day 28 after battery removal. Their strategy consisted of 4 measures: adequate sedation after battery removal, stomach decompression, enteral post-pyloric nutrition, and appropriate supportive antibiotics and antipeptic therapy [12].

In our case, the conservative approach was not an option because surgical intervention is required even for battery removal after the failure of endoscopic removal. The conservative approach avoids surgical complications, adverse outcomes, and multi-stage procedures, and it might be an appropriate option for select patients [11].

### References:


### Conclusions

As some patients with esophageal foreign bodies present with nonspecific symptoms and even in the absence of witnessed ingestion, pediatricians and physicians must raise their level of suspicion in such cases, especially when there are persistent symptoms. Urgent endoscopic removal is the cornerstone of esophageal impacted BB management, and high morbidity and mortality were reported when removal was delayed. Failure of endoscopic removal of the battery is a possibility that requires surgical removal and needs to be included in the management algorithms. Surgical repair is the most frequently described approach for FB-induced TEF repair, but the endoscopic application of electrocautery with fibrin glue is another reported modality of treatment.

### Department and Institution Where Work Was Done

The work was done at the Department of Pediatrics, Maternity & Children’s Hospital, Makkah, Saudi Arabia.

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