CASE REPORT

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Successful management of an aorto-esophageal fistula following button battery ingestion: A case report and review of the literature

Mayuko Wakimoto1, Brittany L Willer2, Christopher Mckee2, Olubukola O Nafiu2, Joseph D Tobias2
1 Department of Anesthesiology and Pain Medicine, Nationwide Children's Hospital, Columbus, Ohio, USA
2 Department of Anesthesiology and Pain Medicine, Nationwide Children's Hospital; Department of Anesthesiology and Pain Medicine, The Ohio State University College of Medicine, Columbus, Ohio, USA

Correspondence Address:
Joseph D Tobias
Department of Anesthesiology and Pain Medicine, Nationwide Children's Hospital, Columbus, Ohio USA

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Abstract

Foreign body ingestion is a common event among pediatric patients, especially in children less than 6 years of age. Although most cases are relatively benign, with the foreign body passing spontaneously or requiring a brief endoscopic procedure for removal, button battery ingestion is known to cause significant morbidity with the potential for mortality. Although aorto-esophageal fistula (AEF) is a rare complication following button battery ingestion, its clinical manifestations are significant and outcomes are poor. Early diagnosis and aggressive treatment are key in preventing fatal complications. We describe the successful management of an AEF which presented with hematemesis 8 days after removal of a button battery in a 17-month-old female. The literature regarding button battery ingestion and AEF is reviewed and treatment options including intraoperative anesthetic care discussed.

Keywords: Aorto-esophageal fistulae; button battery ingestion; pediatric anesthesia

Introduction

The ingestion of foreign bodies is a relatively common event among pediatric patients. The ingested items generally pass spontaneously or require brief anesthetic care during endoscopic removal. Rarely, severe complications may occur related to tissue damage from the foreign body that is ingested. The most recent data from the National Capital Poison Center reported 3,244 cases of button battery ingestions in 2017, 1986 (61%) of which involved children less than 6 years of age. Although the incidence of button battery ingestion has remained unchanged for the past 30 years, the incidence of moderate, major, or fatal complications has risen dramatically with an almost ten-fold increase as compared with 1985. This change is due to the introduction of a more powerful battery (20 mm, 3-volt) to the household market. All fatalities and 98% of major adverse effects occurred in children less than 6 years of age. The incidence of major morbidity or death in this age group has been reported to be as high as 12.6% compared to a lower incidence of major complication or death in all ages (0.3-1%). Button battery ingestion can result in significant morbidity and mortality including aorto-esophageal fistula (AEF) formation or fistula formation between major blood vessels. We describe the successful management of a life-threatening AEF which formed after button battery ingestion. The literature regarding button battery ingestion and AEF is reviewed and treatment options including intraoperative anesthetic care discussed.

Case Report

Review of this case report and presentation in this format was in accordance with the guidelines of the Institutional Review Board of Nationwide Children's Hospital (Columbus, Ohio). The patient was a previously healthy 17-month-old female infant who presented to the emergency department (ED) with hematemesis and anemia. The patient's past medical history revealed 2 contacts with the ED over the past 10 days for non-specific symptoms including vomiting, diarrhea, congestion, cough, fever, and appetite loss. Discharge diagnoses included gastroesophageal reflux disease and upper respiratory infection. During the current admission, a chest radiograph demonstrated a round, opaque foreign body (23.5 mm), which was presumed to be a button battery [Figure 1]. The patient was immediately scheduled for foreign body removal in the operating room (OR). At the time of pre-operative assessment, the patient was tachycardic (heart rate of 154 beats/minute) and hypertensive (non-invasive blood pressure 108/67 mmHg). The hemoglobin and hematocrit were 8 gm/dL and 21%, respectively, and hence a type and cross was obtained. After pre-oxygenation, rapid sequence induction (RSI) was performed with propofol (3 mg/kg) and rocuronium (1.2 mg/kg) and the trachea was intubated on the first attempt. On endoscopic examination of the esophagus, deep ulcers were noted in the upper third of esophagus; however, no active bleeding or perforation was noted. In addition, the foreign body had passed into the small intestine and no attempt was made to remove it. Given persistent tachycardia in the presence of anemia, the patient was transfused at the completion of the procedure. The patient's trachea was extubated and after an uneventful recovery period in the post-anesthesia care unit and she was transferred to the inpatient ward.
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button battery ingestions have been reported since 1977. Among the 62 fatal cases, 25 (40%) cases were attributed to AEF, 12 (20%) to esophageal perforation or rupture, 11 (18%) to TEF, and 10 (16%) to bleeding, while no specific cause of death was noted in 4 (6%) cases. Of these 307 fatal and severe cases, 30 (9.8%) involved AEF, with only 5 reports of survival [Table 1] and [Table 2]. All of the reported patients with AEF were younger than 4 years of age with an average age of 26 months. More than half of the patients ingested a button battery that was larger than 20 mm and in the majority of cases, the battery lodged in the esophagus. Age younger than 4 years and size of the battery (diameter of 20-25 mm) are the most important predictors of a clinically poor outcome, with an odds ratio of 3.2 and 24.6 respectively. [2] Merely based on size, larger batteries are more likely to lodge in the esophagus, especially in younger and smaller patients thereby increasing the duration of time that there is direct contact between the battery and the surrounding tissues. Although less likely to lodge in the esophagus, our review demonstrates that batteries smaller than 20 mm in diameter can also be associated with severe or fatal outcomes. Therefore, as noted by the most recent guidelines from the National Capital Poison Center, a button battery that lodges in the esophagus, regardless of its size and the age of the patient, should be urgently removed. [3] [4] Given the high risk of morbidity and mortality, specific guidelines have been developed with recommendations for both home care prior to arrival to the hospital and for pathways to facilitate the rapid transport of these patients to the operating room [Table 3].

Table 1: Demographic data of patients with aorto-esophageal fistula after button battery ingestion

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Table 2: Previous reports of aorto-esophageal fistula formation following button battery ingestion

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Table 3: Summary of triage and treatment guidelines for button battery ingestions

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Following button battery ingestion, children may be asymptomatic or manifest non-specific symptoms, especially if a patient is non-verbal age and the ingestion was unwitnessed. These issues can lead to a delayed diagnosis and treatment. In reported cases, the most common signs and symptoms of AEF included hematemesis, vomiting, and abdominal pain [Figure 3]. Although hematemesis may not be a presenting sign, patients may return to the hospital with the abrupt onset of hematemesis following an apparent asymptomatic period after removal of the button battery. Delayed hematemesis has been noted at 2 to 32 days after battery removal. Patients with a history of button battery ingestion who present with hematemesis should be considered to have an AEF. Stabilization of the patient followed by radiologic imaging and upper endoscopy is needed to either confirm or rule out the diagnosis. [6] [22] Diagnostic imaging may include CT or MR angiography to identify the presence of the AEF and its location. Effective care should include a multidisciplinary team including gastroenterology, radiology, general surgery, cardiac surgery, otolaryngology, and pediatric anesthesiology. Although clinically stable at the time of presentation, hematemesis or other presenting signs can be rapidly followed by massive hemorrhage and death.

Figure 3: Literature review demonstrating initial symptoms among children who developed aorto-esophageal fistula following button battery ingestion. The x-axis demonstrates the specific symptom with case numbers listed on the Y axis

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Following a rapid and focused preoperative evaluation, preparations should be made to rapidly transport the patient to the operating room. Given the potential for hemorrhage, adequate venous access and blood products should be available in the operating room. Arterial access may be required for hemodynamically unstable patients and to allow for intermittent laboratory analysis as well as continuous blood pressure monitoring. Intraoperative evaluation of hemoglobin, platelet count, coagulation parameters, and acid-base status may be required. Rapid sequence induction is indicated, as these patients are considered to have a full stomach and may be at risk for aspiration during the induction of anesthesia. The choice of anesthetic agents is based on the patient's hemodynamic status. Surgical access for repair of an AEF generally requires a thoracotomy. Cardiopulmonary bypass may be required during repair of an AEF. Although endovascular aortic repair for an AEF is less invasive and has been reported in adults, to date, there remains only one report in a pediatric-aged patient. [23] [20] Postoperatively, the patient should be monitored in a critical care setting as the ongoing alkali damage may continue for days to weeks.

In summary, although the majority of button battery ingestions in children are resolved uneventfully, severe outcomes
including death or stricture formation have been reported. The potential for severe injury is greater in patients less
than 4 years of age and with ingestion of larger batteries (diameter greater than 20 mm). Tissue injury continues for
days to weeks after removal of the button battery and fistula formation and fatal hemorrhage have been reported. As
the majority of patients require anesthetic care during button battery removal, anesthesiologists should be familiar
with the current guidelines. The reader is referred to references 3 and 5 for further recommendations and updates.\[3\],\[5\] Care by a multidisciplinary team and prompt treatment interventions are key to a successful outcome.

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Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**


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Figures

[Figure 1], [Figure 2], [Figure 3]

Tables

[Table 1], [Table 2], [Table 3]