

CASE REPORT

Successful management of a delayed presented button battery ingestion in a toddler: A case report and literature review

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Key Clinical Message

It is important to note that prevention of button battery ingestion is the most effective way to reduce its incidence and complications. This is unachievable without providing educational plans for parents. Moreover, triage nurses and first-line staff who take the history of patients and physicians should take the history to evaluate the risk of battery ingestion. Plain radiographs can be helpful in this matter, as the presence of “Hallow” and “Steep” signs in the anteroposterior and lateral views, respectively, can help.

Abstract

Foreign body ingestion is a relatively common occurrence in pediatrics, especially among children 1–3 years of age. Although most cases are benign and managed conservatively, those with high-risk subjects such as button batteries can bring about fatal conditions in the minority of cases. In the present study, the history, diagnostic, and therapeutic procedures of a 13-month-old baby with the final diagnosis of button battery ingestion are presented. The parents ignored the symptoms, suspecting that it was a viral infection. The evaluations showed that a battery was lodged in the middle part of the thoracic esophagus, which was removed by an urgent endoscopic procedure. The patient was under observation and on a nothing-by-mouth diet for a week, receiving nutritional fluid with a nasogastric tube. The necrosis, which was obvious after the removal of the battery, was healing in the second control esophagogastroduodenoscopy performed 1 week after the procedure. The stricture was minimal, and no need for dilation was diagnosed. This case report underscores the importance of a timely diagnosis and removal of these cases. This case underscores the importance of the timely presentation of these cases to health care and the risk of delayed removal, such as necrosis, forming fistula, and perforation of the esophagus. The delay can cause necrosis, fistula, and perforation and might lead to irreversible severe complications and even death.

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KEYWORDS

button battery, foreign body ingestion, gastroenterology, necrosis, pediatrics

1 | INTRODUCTION

Button battery ingestions are prevalent among children, and they can cause severe and life-threatening complications due to the electrical and chemical contents of these batteries. They can cause injuries to several body parts depending on the route it goes through.^{1,2} These batteries might affect the vocal cords, upper respiratory system, and gastrointestinal parts. The mucosal lesion can also cause perforation and lead to mediastinitis, strictures, perforations, pneumothoraxes, spondylodiscitis, trachea-esophageal or aorta-esophageal fistulas, and fatal internal hemorrhages. A considerable proportion of life-threatening cases of button battery ingestions are seen in cases of 3V Lithium BBs with a 20mm diameter.^{3–5} Considering that these foreign bodies can lead to necrosis in less than 2h and the perforation of the adjacent tissue in 12h, they are deemed pediatric emergencies that should be addressed as soon as possible.^{1,3,4,6} These foreign bodies most commonly go through the esophagus and lodge in narrower sections such as the aortic arch, thoracic inlet, and gastroesophageal junction. Therefore, the presentation is mostly seen with excessive salivation, difficulty in feeding (dysphagia and vomiting), retching, and regurgitation.^{1,7} However, the diagnosis is not always straightforward. In undetected patients, nonspecific symptoms such as declined thrive, abnormal restlessness, and fever might be seen and can lead to misdiagnosis and mismanagement, particularly in younger children.⁸

The initial step after taking the history and physical exam of patients with suspected foreign body ingestion is taking chest and abdominal x-ray. The batteries in the esophagus are mostly opaque and visible in the chest x-ray as a “double rim” or “halo” sign in an anteroposterior view, and a “step-off” may be visible, as the smaller diameter anode (negative pole) projects from the larger cathode (positive pole) in the lateral view.⁹ Although most cases of BBI are managed safely and without complications, they can become more complicated if disk batteries become lodged in the nasopharynx, oropharynx, trachea, esophagus, or GI tract and lead to local injury, ulceration, perforation, or fistula formation. The resultant damage can be seen in the short term. However, the presentation is mostly delayed, and long-term complications might appear after several days or weeks.³ If they are not addressed urgently, the perforation of the esophagus and the involvement of the mediastinum can result in severe complications, the need for surgery, and even death.^{1,10}

The present study discusses a case of button battery ingestion by a 13-month-old toddler, which resulted in the necrosis of the esophagus due to the late presentation and diagnosis. The main aim is to highlight the importance of a high level of suspicion, careful history taking and physical exam, and timely radiologic evaluation to differentiate this life-threatening condition from its differential diagnoses.

2 | CASE PRESENTATION

2.1 | Patient's history and physical examination

A 13-month-old white female was brought to the emergency department complaining of cough, excessive saliva secretion, and being unable to drink or eat anything. Symptoms had started one and a half days before his presentation. Still, it was ignored by the mother, and the father has been out of the house for a couple of days. The family lived in a rural area far from the closest healthcare center. The mother noted that the patient had been unsupervised for a couple of hours, playing with her dolls while cooking in the kitchen. When she was playing with her toys unsupervised. The mother, who was with her at home, noticed no specific triggers. The symptoms started abruptly, and no preceding symptoms were detected. The mother noticed unusual acting and declined oral intake and an occasional dry cough. Those symptoms continued this morning. The mother mentioned that the child was alone playing with her dolls, but no small object was around her when she asked about the probability of foreign body ingestion. Both parents denied any recent disease, including fever, vomiting, diarrhea, rash, sick contacts, or recent trauma. The evaluation of the patient's medical history showed she was a healthy and developmentally normal girl. She had no chronic medical conditions and no previous hospitalizations or surgeries. Her last well-child examination was at 12 months of age (1 month before her presentation), and she was current on immunizations. She had no known allergies and took no prescription, over the counter, or herbal medications. There was no relevant family history. The father was being treated for a medical condition, and the mother had been using levothyroxine for her hypothyroidism. The toddler's personal, social, and developmental history showed no

remarkable point. The child lived with her mother and father. The father was a taxi driver, and the mother was a housekeeper and not working outside the house. The mother criticized the mother and attributed the child's symptoms to insufficient supervision by her. No history suspicious for child abuse and involvement of Child Protective Services were detected.

In the physical exam, the general appearance seemed mildly agitated and restless. The drooling was obvious, and the patient was breathing normally with intermittent short crying periods. Her vital signs on arrival at the emergency department were within the normal range except for the tachypnea, temperature of 36.6°C, blood pressure of 113/66 mmHg, pulse of 135 beats/min, respiratory rate of 35 breaths/min, and oxygen saturation of 99% on ambient air. The skin color was normal with a 2-s capillary refill time. No remarkable abnormal sign could be detected in her physical exam, and no sign of respiratory distress, stridor, retractions, or nasal flaring could be seen. Her breath sounds were clear, with equal air entry to both lungs. However, her mouth was full of saliva, and she could not drink or swallow it. As much the examination was possible. No foreign bodies were visualized in the nasal cavity or bilateral ear canals. Her abdomen was soft with audible bowel sounds and no tenderness with palpation. No other remarkable sign could be detected.

2.2 | Methods

Considering the probability of foreign body ingestion, a chest and an abdominal x-ray were requested, demonstrating a round radiopaque foreign body projecting over the thoracic middle part of the esophagus. The approximate measurement showed a diameter of 20 mm in diameter by 2.5 mm thickness, with a steep sign on the lateral view and a hollow sign in the anteroposterior, suggestive of a button battery lodged in the thoracic esophagus (Figure 1).

Considering the time had passed from the initiation of symptoms, the endoscopy room was notified to be prepared immediately, and the on-call pediatric gastrointestinal specialist was requested to be there immediately. The patient was sedated by an anesthesia specialist with intravenous midazolam (0.75 milligrams per kilogram) after putting in oxygen nasal canola. In the meantime, she was prepared and positioned supine by the operating room staff. The endoscope entered the mouth and then the initial part of the esophagus without any specific abnormal finding. When it was pushed further, a silver foreign body was obvious (Figure 2). It was lodged in the esophagus and could hardly be grasped by the endoscopic device. However, after several attempts, the battery was grasped and removed cautiously to avoid any pressure or chemical

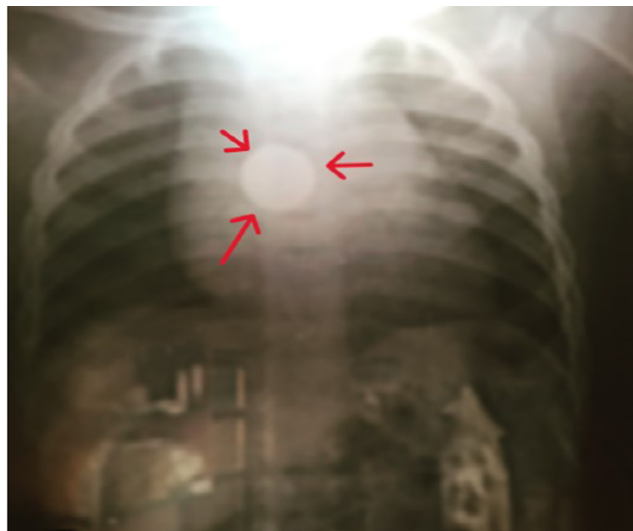


FIGURE 1 The patient's chest x-ray showed a round-shape foreign body in the middle of the thoracic esophagus. The diameter was measured to be 2.4 cm, and the thickness was 0.6 cm.



FIGURE 2 The foreign body could be detected in the medial part of the thoracic esophagus. It was lodged and could be grasped after several attempts. Then, it was taken out slowly to avoid any chemical or pressure injury to the esophagus.

injury. No abnormal finding was detected in the patient's laboratory data.

The evaluation of the esophagus after the battery was removed showed that the section involved in the battery lodgment was inflamed and necrotized; however, no perforation could be detected (Figure 3). There was evidence of mucosal ulceration in the mid-esophagus, approximately 3.5 cm in length, and necrosis on the lateral aspect of the wall but no perforation. Because there was no perforation, the injured area was incrementally rinsed with 100 mL of 0.25% sterile acetic acid (weak acid). The battery, which was a 3 V Lithium button battery, was also evaluated (Figure 4). The postoperative diagnosis was CR2025 lithium Cell 3 V battery in the thoracic esophagus with mucosal ulceration.



FIGURE 3 There was evidence of mucosal ulceration in the mid-esophagus, approximately 3.5 cm in length, and necrosis on the lateral aspect of the wall but no perforation.



FIGURE 4 A CR2025 battery is a non-rechargeable lithium coin or “button” cell that is 20 mm in diameter and 2.5 mm in thickness.

2.3 | Outcomes and follow-ups

After the procedure, the patient was transferred to the pediatric intensive care unit (PICU) under close observation and cardiac monitoring. The diet was determined to be Nil Per Os (NPO) to prevent further physical injury to the necrotized area and perforation. The feeding through the nasogastric tube started the day after the procedure. The NG feeding continued for 1 week, and the IV fluid was stopped 2 days after the procedure. The patient was transferred to the general pediatric wards 2 days after the endoscopic procedure. The observation was continued for two more days, and no complications were detected

during this period. She was discharged 5 days after the ingestion, and the day after, he could tolerate oral fluid with no complications. One- four- and eight-week follow-ups were done, and no abnormal symptoms or signs were mentioned or detected. An esophagogastroduodenoscopy was performed 1 week after the initial procedure, demonstrating appropriate healing and minimal stricture without any indication of dilation of the esophagus. She had no difficulty growing and gained normal weight during the one-year follow-up after the event.

3 | DISCUSSION

One of the most life-threatening types of foreign body ingestion is the ingestion of button batteries. These events occur mostly in children younger than 6 years old and most commonly between 1 and 3 years old.¹¹ Although most cases (97%) are benign and result in no serious complications, those with severe features can lead to serious injuries to the trachea, esophagus, or laryngeal nerves.¹² Damages to these tissues can result in injury, ulceration, and perforation in the acute form and the long-term (delayed) injuries. Symptoms might be seen for days to several weeks.³ The mechanism of injury in these cases is different, ranging from local pressure necrosis, corrosive damage due to the release of chemical contents, toxicity by heavy metal contents, and electrical injuries as the most commonly seen mechanisms.¹

The presentation of these symptoms varies based on the location of the battery. The most common symptoms in the case of GI tract involvement are nausea, vomiting, dysphagia, irritability, and abdominal pain. The most common location of lodgment is narrow parts of the esophagus. If they go through the stomach, they will be passed from the lower gastrointestinal part. The size of the battery is also important, especially in cases where the battery is larger than 20 mm in diameter. If the period between ingestion and removal is more than 2- hours, the risk of serious injuries is higher.¹⁰ The diagnosis and the determination of the location of battery lodgment are not always straightforward, and the symptoms might not be specific.¹³ Therefore, the role of radiologic evaluation is crucial. Most of the time, the plain radiologic review is enough, and it should be done in both axes, anteroposterior and lateral, to distinguish the objects from each other (coin and button batteries) and also the precise location of the objects. Sometimes, serial imaging is necessary to make sure about the lack of stricture and perforation.¹⁴

Approaches to cases of button battery ingestion should be planned based on the patient's age, type, and battery size. In asymptomatic low-risk cases, follow-up with serial radiographs is recommended for up to 2 weeks. In

high-risk cases, children younger than 6 years or batteries with a diameter >15 mm should be serially assessed every 4 days. In cases where they do not pass through the stomach, they should be removed endoscopically. Moreover, those younger than 5 years old or with battery sizes ≥ 20 mm should be urgently approached by endoscopic removal.^{15,16} The guidelines noted that the optimal management of these cases is incremental irrigation and suction to remove debris with 50–150 mL of 0.25% sterile acetic acid. The safer approach to removing button batteries is via direct visualization rather than retrieval by balloon catheter or magnet, considering the opportunity to visualize tissue injury.¹ The setting of the endoscopic procedure is also important to consider based on the severity of symptoms and the probability of the need for open surgical removal. Those with high-risk conditions should be done in cardiac catheterization rooms or operation rooms. Patients with button battery ingestion should remain NPO, and follow-up endoscopic evaluations should be performed to assess the healing process. In cases where vessels (aorta) are involved, it is recommended to perform angiography to ensure vascular integrity.

An important point regarding button battery ingestion is public awareness and parents' and guardians' knowledge about how these incidents should be prevented and managed.¹⁷ Previous research has also shown although most parents have enough awareness, there are considerable knowledge gaps that should be addressed by public health and policymakers.¹⁸ The disposal of a battery is crucial since the dead battery still has hydroxide ions, which can be enough to damage the tissue it is in contact with.⁷ In a study by Lahmar et al, it has been shown that approximately two-thirds of these events are preventable by measures such as screw-secured compartments. They have also emphasized that this intervention is not successful without collaboration with industries and highlighting the importance of their preventive measures.¹⁹ Other unproven methods, such as providing unattractive bitter taste covers for batteries, have been proposed by previous literature.²⁰ Moreover, timely management, which begins with the parent's intervention, is a crucial step regarding the fact that delay in the removal of the battery and necessary treatments can result in the extension of the injury and more irreversible damages.²⁰

4 | KEY CLINICAL POINT

The most important point in button battery ingestion management is its prevention. Parents should be educated about the high probability of this event in children who are discovering their surroundings and might put the batteries of their toys or dolls in their mouth, specifically in

the age between 1 and 3 years old. The importance of identifying the foreign object and distinguishing button batteries from coins should be considered by triage nurses and those who take the history in the first place, considering the fact that delay in the removal of batteries can result in irreversible changes in the structure of the esophagus due to electrical or chemical injuries. An educated multidisciplinary team should conduct the treatment consisting of pediatric gastroenterologists, educated nurses, and anesthesiologists.

AUTHOR CONTRIBUTIONS

Pouya Ebrahimi: Conceptualization; data curation; formal analysis; project administration; resources; supervision; writing – original draft. **Roozbeh Nazari:** Conceptualization; data curation; formal analysis; project administration; resources; supervision; writing – original draft. **Seyedeh Maryam Mousavinezhad:** Investigation; methodology; supervision; validation; visualization; writing – review and editing. **Nahid Senobari:** Investigation; methodology; supervision; validation; visualization; writing – review and editing. **Delaram J. Ghadimi:** Investigation; methodology; supervision; validation; visualization; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data is available on request due to privacy/ethical restrictions.

CONSENT


Written informed consent was obtained from the patient to publish this report in accordance with journal's patient consent policy, and the procedure was performed in accordance with the center's ethical policy.

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REFERENCES

1. Eliason MJ, Melzer JM, Winters JR, Gallagher TQ. Identifying predictive factors for long-term complications following button battery impactions: a case series and literature review. *Int J Pediatr Otorhinolaryngol*. 2016;87:198-202.
2. Jatana KR, Litovitz T, Reilly JS, Koltai PJ, Rider G, Jacobs IN. Pediatric button battery injuries: 2013 task force update. *Int J Pediatr Otorhinolaryngol*. 2013;77(9):1392-1399.
3. Litovitz T, Whitaker N, Clark L, White NC, Marsolek M. Emerging battery-ingestion hazard: clinical implications. *Pediatrics*. 2010;125(6):1168-1177.
4. Soto PH, Reid NE, Litovitz TL. Time to perforation for button batteries lodged in the esophagus. *Am J Emerg Med*. 2019;37(5):805-809.
5. Shaffer AD, Jacobs IN, Derkey CS, et al. Management and outcomes of button batteries in the aerodigestive tract: a multi-institutional study. *Laryngoscope*. 2021;131(1):E298-E306.
6. Al Lawati TT, Al Marhoobi RM. Timing of button battery removal from the upper gastrointestinal system in children. *Pediatr Emerg Care*. 2021;37(8):e461-e463.
7. Sethia R, Gibbs H, Jacobs IN, Reilly JS, Rhoades K, Jatana KR. Current management of button battery injuries. *Laryngoscope Investig Otolaryngol*. 2021;6(3):549-563.
8. Oftring ZS, Mehrrens DM, Mollin J, Hamelmann E, Gaus S. Chronic stridor in a toddler after ingestion of a discharged button battery: a case report. *BMC Pediatr*. 2024;24(1):246.
9. Ohns MJ. Button battery ingestion: a case report. *J Pediatr Health Care*. 2022;36(5):465-469.
10. Newman RK, Dijkstra B, Gibson J. *Disk Battery Ingestion*. StatPearls; 2023.
11. Barabino AV, Gandullia P, Vignola S, Arrigo S, Zannini L, Di Pietro P. Lithium battery lodged in the oesophagus: a report of three paediatric cases. *Dig Liver Dis*. 2015;47(11):984-986.
12. Meltzer L. Ileocolic perforation secondary to disk battery ingestion in a dog. *J Am Anim Hosp Assoc*. 2018;54(5):e54501.
13. ETTYREDDY AR, GEORG MW, CHI DH, GAINES BA, SIMONS JP. Button battery injuries in the pediatric aerodigestive tract. *Ear Nose Throat J*. 2015;94(12):486-493.
14. Thabet MH, Basha WM, Askar S. Button battery foreign bodies in children: hazards, management, and recommendations. *Biomed Res Int*. 2013;2013:846091.
15. Leinwand K, Brumbaugh DE, Kramer RE. Button battery ingestion in children: a paradigm for management of severe pediatric foreign body ingestions. *Gastrointest Endosc Clin N Am*. 2016;26(1):99-118.
16. Kramer RE, Lerner DG, Lin T, et al. Management of ingested foreign bodies in children: a clinical report of the NASPGHAN endoscopy committee. *J Pediatr Gastroenterol Nutr*. 2015;60(4):562-574.
17. Philteos J, Madan Y, James AL, et al. Public knowledge of button battery ingestions: a social media based cross-sectional analysis. *Int J Pediatr Otorhinolaryngol*. 2024;179:111902.
18. Girardi AM, Long DN, Austin G. 'You can be as vigilant as you can, yet they make their way in': A descriptive study of parent and caregiver perspectives towards keeping children safe from button batteries. *J Pediatr Gastroenterol Nutr*. 2024;1-6. doi:[10.1002/jpr3.12096](https://doi.org/10.1002/jpr3.12096)
19. Jatana KR, Chao S, Jacobs IN, Litovitz T. Button battery safety: industry and academic partnerships to drive change. *Otolaryngol Clin N Am*. 2019;52(1):149-161.
20. Mubarak A, Benninga MA, Broekaert I, et al. Diagnosis, management, and prevention of button battery ingestion in childhood. *J Pediatr Gastroenterol Nutr*. 2021;73(1):129-136.

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