Published online: 2019-09-24

Case Report

Complicated Cases of Lithium Battery Ingestion: Delay can be Deadly

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Abstract

Increasing use of button battery (BB) in household products and toys is responsible for the growing incidence of button battery ingestion (BBI). The BBI may cause life-threatening complications. We present a series of three cases of complicated BBI (lithium cell) with delayed presentation; one of them could not survive due to tracheoesophageal fistula and sepsis. Here, we highlight the importance of early endoscopic intervention and careful follow-up in children with lithium battery ingestion.

Keywords: *Button battery, disc battery, esophageal stricture, lithium cell, tracheoesophageal fistula*

Introduction

Children constitute around 80% of patients presenting with foreign body ingestion. Foreign body ingestion is common in toddler, especially between 6 months and 3 years of age.[1] About one-third of these patients remain asymptomatic after ingestion of foreign body.[2] Increasing use of button battery (BB) in household products and toys is responsible for the growing incidence of button battery ingestion (BBI).[3] BBI may cause life-threatening complications. We present a series of three complicated cases of BBI with delayed presentation; one of them could not survive due to tracheoesophageal fistula (TEF) and sepsis.

Case Reports

Case 1

An 11-month-old boy with normal developmental milestones presented to secondary health care center with a history of BBI a few hours back, while he was playing with a musical toy. The child was asymptomatic. Chest X-ray showed a disc-shaped radio-opaque shadow at the level of T4 vertebra [Figure 1a]. Serial radiographs confirmed that the battery migrated to the lower abdomen near the pelvic brim. One week later, the child passed battery in the stool. Repeat radiograph showed no radio-opaque shadow. A treatment document did not show the follow-up details.

One month later, the patient referred to us with 2 weeks history of fever, cough, vomiting after feeding, and 2.5 kg loss of weight. Clinical examination showed poor nutritional status, tachycardia, tachypnea, pallor, fever, and bilateral chest crackles (left > right). Blood investigations showed hemoglobin of 10 g/dL and leukocyte count of 16,000/mm≥ (polymorphs 88%); the rest of the parameters were normal. Chest X-ray showed bilateral upper zone opacity suggestive of pneumonia. Endoscopy revealed an opening (about 1 cm) at the left esophageal wall just distal to cricopharynx suggestive of TEF [Figure 1b]. A nasogastric tube was placed. The fistula was repaired via a lateral neck incision of fistula after 1 week of antibiotics and nutrition support. The fistulous tract was divided, and repair of both trachea and esophagus was performed with placement of a muscle flap between them. The patient succumbed to death on the 4th postoperative day due to uncontrolled sepsis and shock.

Case 2

An 11-year-old boy presented to the pediatrician with recurrent vomiting. The symptom was gradually progressive, and the patients did not improve after 3 months of symptomatic treatment. Three months later, the patient developed dysphagia. Chest X-ray showed a coin-like object in the esophagus [Figure 2a]. Endoscopy

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Access this article online

Quick Response Code:

Website: www.jdeonline.in

DOI: 10.4103/jde.JDE_86_17

How to cite this article: Suchismita A, Ranjan R, Jha AK, Jha P, Choudhary M, Dayal VM, *et al.* Complicated cases of lithium battery ingestion: Delay can be deadly. J Dig Endosc 2018;9:184-7.

showed a BB in the mid-esophagus. The patient was referred to us for its removal. We retrieved a lithium battery (size 20 mm) impacted in the mid-esophagus. Endoscopy after retrieval revealed a short-segment mid-esophageal stricture with irregularly thickened mucosa [Figure 2b]. Endoscopic dilatation of stricture was performed. The patient was able to swallow satisfactorily on discharge.

Case 3

A 3-year-old boy presented to us with a history of BBI 4 days ago, and dysphagia. The patient was managed conservatively for 3 days before being referred to us. An urgent endoscopy was performed which showed a BB embedded in the mucosa of the upper esophagus. BB (lithium battery, size 20 mm) was gently retrieved with the use of the foreign body forceps [Figure 3a and c]. Repeat endoscopy after retrieval showed a deep esophageal ulcer and mucosal burn [Figure 3b]. The patient was kept orally for 48 h; intravenous fluids and antibiotics were prescribed. The patient was discharged on postprocedural day 3. During a month of follow-up, the patient showed no further complication.

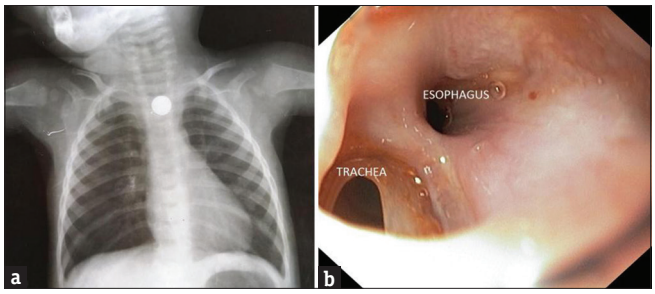

Figure 1: (a) Button battery at level of T4 vertebrae (chest X-ray), (b) tracheo-esophageal fistula after 1 month of battery ingestion (endoscopy)

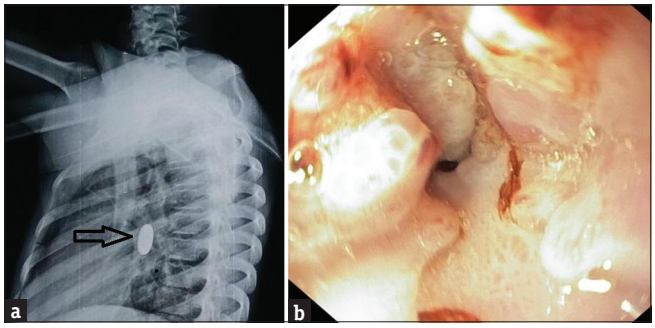

Figure 2: (a) A button battery on a lateral view of chest X-ray, (b) short-segment esophageal stricture with irregular thickened mucosa at the site of impacted lithium battery (endoscopy)

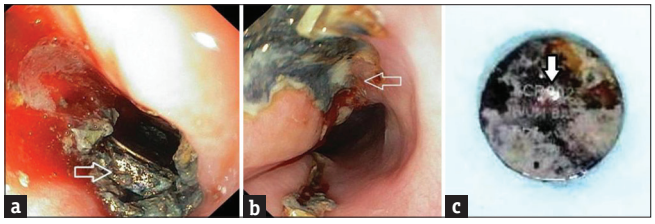

Figure 3: Endoscopic images showing impacted lithium battery (a), esophageal ulcer with mucosal burn (b), and retrieved lithium battery with imprint code (c)

Discussion

BB containing lithium is being increasingly used in various electronic devices. Various types of BB can be recognized by their imprint codes (CR2032: lithium, 20 mm diameter, 3.2 mm height; SR516: silver, 5.8 mm diameter, 1.6 mm height; LR1154/SR1154: alkaline/silver, 11.6 mm diameter, 5.4 mm height). In two of the three cases of current case series, lithium body (LB) was identified by their imprint codes. However, Case 1 presented to us after the passage of the battery in the stool; therefore, the parents were asked to bring the musical toy for confirmation of the type of battery.

Studies showed worsening outcomes for BBIs, paralleling the increase in ingestion of 20 mm LB. Nearly all severe complications of BBI are associated with lithium cells. In a study, major complications were noted in 13% of children (<6 years of age) with LB (>20 mm) ingestion.[4] In a study by Lahmar *et al*., all children (<15 years of age) presenting with BBI with esophageal impaction requiring emergency removal were analyzed. Twenty-five of the 26 batteries had diameters of ≥20 mm. Esophageal impaction time ranged from 2 to 72 h. The complications rate was 23%.[5] In another study by Litovitz *et al*., complications in major outcome cases were TEF, esophageal perforations, esophageal strictures, and vocal cord paralysis in 48%, 23%, 38%, and 10% of patients, respectively.[3] Study of 13 severe cases of BBI showed esophageal perforation, esophageal stricture, and mortality in 31%, 23%, and 23% of cases, respectively.[6] In a study from the United States, 12 patients with BBI (all aged <4 years) expired mainly because of gastroesophageal hemorrhage due to aortic-esophageal fistula, TEF, and esophageal perforation.[7] Other complication includes mediastinitis, aspiration pneumonia, empyema, lung abscess, pneumothorax, pneumoperitoneum, tracheal stenosis or tracheomalacia, and spondylodiscitis.[3,8]

Predisposing factors for severe complications include battery containing lithium, larger battery (>20 mm), younger age (<4 years), location in the esophagus, and delayed endoscopy. Ingestion of multiple batteries, unnoticed ingestion, unknown ingestion time, the absence of endoscopy facility, and misdiagnosis are other risk factors for serious complications.[3,9] The absence of endoscopy facility and the migration of battery toward

the lower abdomen on serial radiographs were the possible reasons for the failure to order endoscopy in case 1 of the present case series. BBI went unnoticed in Case 2.

The following mechanisms are responsible for the battery-related injury: (a) electrical discharge hydrolyzes tissue fluids and produces sodium hydroxide at the battery's negative pole, (b) leakage of hydroxide ion, and (c) local pressure effect. Hydroxide is the main factor for mucosal injury. Hydroxide accumulation causes continued injury despite the removal of the BB. In comparison to other BB (1.5 V), LB is larger (≥20 mm), have a higher voltage (3 V), generate more current and therefore produces more hydroxide. LB can cause serious mucosal injury within 2 h of ingestion.[3,5]

In a child with foreign body ingestion, a careful history is required to diagnose BBI. The physician should consider BBI if a toddler presented with symptoms such as vomiting, dysphagia, coughing, fever, airway obstruction or wheezing, drooling, chest discomfort, refusal to eat, choking, or gagging with feeding. In two new studies from Europe, vomiting (31.3%), dysphagia/feeding difficulties (31.3%), fever (31.3%), and fever with a cough (26.42%) were the most common presenting symptoms; however, 18.8% of the patients were asymptomatic. In these studies, the batteries were removed by endoscopic (87.5%) or surgical (12.5%) methods.[8,10] All patients with suspicion of BBI require immediate radiograph, except asymptomatic ingestions of <12-mm size batteries in patients who are more than 12 years of age. Radiographs should be analyzed for battery's double-rim or halo effect on anteroposterior view or step-off on the lateral view, to rule out the "coin" or "coin-like objects."[4,11]

Endoscopy is indicated to confirm the diagnosis, assess the severity of injury and to remove the battery. Current guideline indicates immediate endoscopy and removal of esophageal ingested batteries >12 mm in size and in all patients under 12 years of age.[12] Serious mucosal injuries can occur without esophageal impaction and symptoms can be observed even after the passage of battery.[13] The first case presented with TEF after a week of passage of battery. North American society for pediatric gastroenterology, hepatology, and nutrition endoscopy committee advocates endoscopic retrieval of all esophageal as well as gastric ingestions of disc batteries >20 mm and/or in children <5 years of age.[14] Smaller batteries lodged in the stomach or beyond in an asymptomatic patient of an older age should be left to pass spontaneously. Inspection of the stool or repeat radiograph in 10–14 days is warranted to confirm passage.

Several issues are still not clear such as frequency of endoscopy or imaging, duration of hospitalization/observation, duration of esophageal/gastric rest, and use of antibiotics. Therefore, the clinician's individual decision is very important for the management of BBI.

Fistula formation may be delayed up to 9–18 days after battery removal; therefore, follow-up is required even in the absence of fistula at the time of endoscopy. In our first case, the patient became symptomatic after 2 weeks of BBI. Children with unnoticed BBI may present several months later with delayed complications such as esophageal stricture and tracheal stenosis. One of the three cases of the current case series presented after 3 months of unnoticed BBI.

Conclusion

Lithium battery ingestion can lead to life-threatening complications. Early endoscopic retrieval of the battery is required to avoid severe complication in young children with lithium battery ingestion. Young children with ingestion of lithium battery of larger size should receive careful follow-up for early detection of delayed complication. The patients with unnoticed ingestion of a BB may present several months later with delayed complications such as esophageal stricture.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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