

## Rare Presentation of Prolonged Impaction of A Button Battery in Esophagus without Life-Threatening Consequences

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### Abstract

The diagnosis of button battery ingestion in toddler age group can be quite difficult as the patient cannot give the history himself/herself (unless it is witnessed). Such ingestion can lead to serious complications due to either mechanical obstruction of the foodpipe or leakage of alkaline liquid from the battery which can cause necrosis and perforation of the GI tract leading to death if not intervened early. It is very rare to see prolonged impaction of a button battery in the esophagus without any life-threatening complications. We hereby describe a case of a one and a half year old boy who ingested a button battery approximately 20 days back (unwitnessed) which got impacted in the esophagus and remained there for about 20 days before presenting to us with complaints of poor feeding, cough and fever. He was managed in the pediatric ICU where the button battery was retrieved and the child was discharged in a stable condition.

**Keywords:** Upper Gastrointestinal Endoscopy (UGIE); Impacted Foreign Body (FB); Button Battery (BB); Foreign Body Ingestion; Chest X-Ray (CXR); Pediatric Age Group; Hypopharynx; Cricopharynx; Upper Airway Obstruction; Nasogastric Tube (NGT); Perforation; Tracheoesophageal Fistula (TEF); Aorto-Esophageal Fistula (AEF); Stricture; Fibrosis; Direct Laryngoscopy (DL); Alkaline Caustic Exposure; Liquefactive Necrosis.

### Introduction

Button Battery (BB) Ingestion will mostly present as other foreign bodies (FB).

- a. Cough & gagging
- b. Drooling & difficulty in swallowing
- c. Stridor and laboured breathing
- d. Croup-like symptoms
  - i. Acute stridor without any other commonly associated viral disease symptoms.
  - ii. Recurrent stridor should be considered for airway FB.
- e. Chest X-ray should be ordered in paediatric

age group with first time episode of wheezing to rule out FB ingestion [1].

The patient may have non-specific symptoms that initially do not relate to a FB ingestion case, but are because of the gradual evolution of tissue damage.

1. Vomiting
2. Fever
3. Irritability
4. Poor feeding
5. Listlessness [1]

Tissue damage from BB is because of alkaline caustic exposure.

- Alkaline caustic exposure does lead to liquefactive necrosis.

- When the BB is situated in a moist environment (like mucous membranes or saliva), an electrical charge is generated.
- The Lithium BBs have twice the capacitance of other BBs (3 volts as compared to 1.5 volts).
- Lithium BB have been associated with worse outcome as it can generate more current.
- Even used Lithium BBs can cause tissue damage by generating enough current which causes hydrolysis of water, causing alkaline injury by generating hydroxide ions [1].

There has been a steady increase in incidence of BB ingestion over the last few decades which can be attributed to the increased usage of button batteries in household appliances and toys. The primary mechanism by which the BBs cause damage is by leakage of the battery contents into the moist oesophageal environment which causes direct corrosive damage. The leaked alkaline electrolyte solution penetrates deep into tissues producing liquefactive necrosis. This damage can occur within a very short period of time and, therefore, early identification is very important. Paediatric age group patients usually present with non-specific clinical features like vomiting, painful swallowing and drooling of saliva [2].

An X-ray of the neck and abdomen showing the 'double contour' appearance should be performed for confirmation of the type of foreign body and impaction site localization. Serious complications like oesophageal perforation, mediastinitis, trachea-oesophageal fistula and esophageal stenosis can occur [2].

FB ingestion is a common paediatric emergency. Most of the foreign bodies pass thorough the gastro-intestinal tract uneventfully. Intervention for foreign body retrieval is seldom indicated when it is located beyond esophagus. Although majority of cases do not develop any complication, severe injury might occur depending on type of object swallowed and its location. BBs represent about 2% of all FBs, but with an increasing trend.

They seldom remain in the esophagus; however, these few cases are prone to develop severe injury even after some hours. BBs that are located in esophagus mainly cause damage by a few independent mechanisms. 1) They might cause damage in surrounding tissue because of direct pressure, as any other foreign body, although this

alone should not cause severe injuries. 2) Batteries containing mercury do release it, thus causing its systemic circulation and absorption which can cause systemic toxicity. 3) Alkaline leakage causes caustic damage in esophageal mucosa.

Alkaline caustic burns are characterized by fat saponification, inflammatory cell infiltration and liquefactive necrosis [3] BBs are most likely to be lodged in esophagus in younger patients because of their smaller esophageal lumen diameter. Most severe injuries and fatalities involve patients younger than 3 years.

Most of the BBs have large diameters, i.e. 20 mm or more, which find it difficult to go through esophagus. The anatomical structure of esophagus explains why BBs remain impacted mostly in the upper portion: the aortic arch, the cricopharyngeus sling, and the initial portion of left bronchus make the esophageal lumen diameter physiologically smaller and therefore, the FB is more likely to remain in the upper esophagus [3].

Although difficulty while swallowing and painful swallowing are common clinical features but they are not always present and non-specific symptoms might make the diagnosis difficult in cases where the BB ingestion was unnoticed. This is the reason why some cases are diagnosed even weeks after the event. Special attention must be paid to infants and toddlers that show non-specific symptom without any apparent reason. Foreign body ingestion possibility should always be taken into consideration [3].

After establishing diagnosis, urgent endoscopy should be performed. Some other methods are also known to be used to remove the BB such as by using emetics, a Foley catheter or a magnet, but they do not seem to be safe enough and a complete esophageal exploration should be done to check the esophageal mucosa, to assess the injury and rule out early complications.

When the BB is located beyond the stomach, serial radiographic examinations should be used to monitor its progress and advancement through the gastrointestinal tract [3].

Colonic enemas, whole bowel irrigation and cathartics have all been used successfully to evacuate disk batteries situated below the pylorus in pediatric BB ingestions [4].

Serious and fatal BB ingestions are increasing in frequency as a result of the increasing household popularity of the 20-mm lithium coin cell. Health professionals must consider the diagnosis of BB ingestion, accurately differentiate batteries from

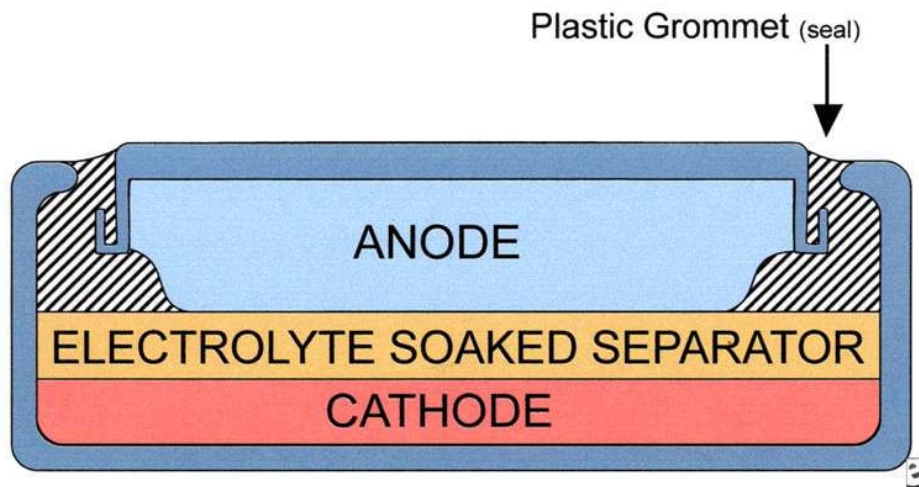


Fig. 1: Schematic diagram of a battery

coins and immediately remove batteries that are lodged in the esophagus to improve outcomes. Severe injury can occur in just 2 hours, and delayed complications must be anticipated [5].

### Case Study

*Note: A detailed history with the mother as the historian was taken in the Emergency Department.*

A one and half years old male child who was apparently well 20 days back, developed sudden onset cough and cold. Cough was sudden in onset, non productive, non paroxysmal, without any postural or diurnal variation which gradually worsened in intensity. The patient developed fever after 2-3 days of cough. He also has been having poor oral intake since the last 20 days. He was treated outside on OPD basis with oral antibiotics, oral antipyretics and nebulization with bronchodilators which he took for 3-4 days but his symptoms persisted.

He was then brought to our ER for further evaluation. He was conscious and oriented but mildly irritable and lethargic.

His Pulse Rate=112/min, BP=90/50 mmHg in right arm supine position, SpO<sub>2</sub>=99% on room air, Respiratory rate=30/min, temperature of 98.3°F and a weight of 9 kg.

The patient had mild pallor, no icterus, no cyanosis, no edema, no lymphadenopathy, no edema.

The mother had full term normal delivery at a hospital with no antenatal and postnatal complications. Development was appropriate for age and the child was immunized as per age.

Neurology: Conscious, slightly irritable, B/L pupil normal in size and reacting to light, no cranial nerve deficit

CVS: S<sub>1</sub>S<sub>2</sub> heard. No murmurs

RS: Normal vesicular breath sounds bilaterally

Per Abdomen: No visible scars or sinuses, Soft, no distention, bowel sounds (+)

An immediate Chest X-Ray was ordered for the first time which revealed a radio-opaque, circular foreign body in the hypopharynx area (Figure 2 & 3)

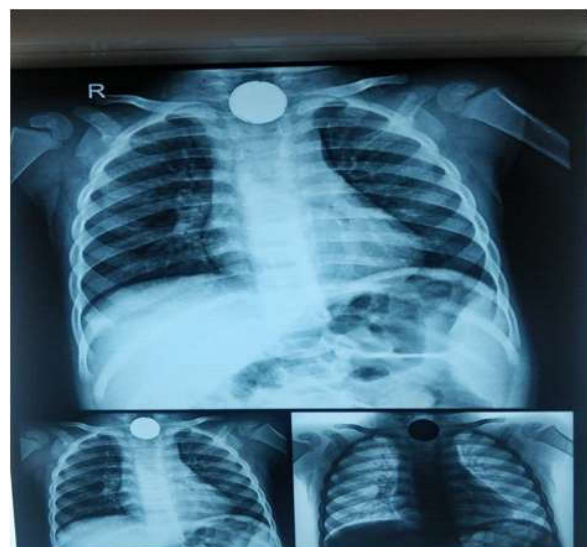


Fig. 2: Chest X ray AP view



Fig. 3: Chest X ray lateral view.

On further history-taking, the parents could reveal that the child was apparently playing with some toys 20 days back and 1-2 button batteries were found to be missing on investigations later.

A provisional diagnosis of foreign body ingestion with impacted button battery was made based on patient's X-ray in the Emergency Department. Immediate pediatric consultation and gastroenterology consultation were sought and the patient was shifted to pediatric ICU.

Direct laryngoscopy was performed the same day which could not reveal any foreign body.

Gastroenterology team performed upper GI endoscopy under General Anesthesia along with Pediatric Surgeon. During Upper GI endoscopy foreign body was localized around cricopharynx. There was associated marked edema and large ulcer around it. Initial attempt to retrieve the battery was unsuccessful due to fibrosis and milder sedation to the patient. He was posted for OT for removal under general anaesthesia. The impacted foreign body was retrieved with snare after dissecting the fibrosis around the foreign body. CXR post procedure showed no evidence of perforation. Nasogastric tube (NGT) was inserted under endoscopic guidance and secured.

Child was started on NG feed 24 hours post procedure which was tolerated well.

The parents were counselled and trained at the hospital about NG feed and how to check the NG tube.

The patient was discharged after 2 days and planned for Barium swallow after 2 weeks.

Post-discharge follow up was uneventful and unremarkable.

### Discussion and Therapeutic Considerations

Revised treatment guidelines promote expediton of removal of BB from the esophagus, increase vigilance for possible delayed complications, and identify the need for urgent radiographs [6].

Esophageal BBs have emerged as the one of the most critical and urgent indication for emergency endoscopy in paediatric patients. The reason behind this dramatic increase in both morbidity and mortality seems to be linked to two specific changes in the BB market through that time period: increased diameter and a change from other BBs to lithium BBs [7].

The larger diameter results in increased chances of its impaction in the esophagus, and the lithium composition results in increased voltage delivery. Lithium BB became the preferred BB because of its longer shelf life, lighter weight, better stability at cool temperature and ability to carry twice the voltage of previously used mercuric oxide, manganese dioxide, and zinc-air cells. As a result, lithium cell ingestion rose from approximately 1% in 1990 to almost 25% of all of the BB ingestions by 2008. In addition to that, the ingestion of BBs more than 20 mm in diameter increased from 1% to 18% during the same time period, and comprised 94% of known fatalities. This combination of both larger size and change to lithium composition of BBs seem to be important, because outcomes for lithium BB ingestion carries 3-fold greater risk of injury compared with spent batteries. Extreme caution must be maintained with all of the BB ingestions as they can cause injury even once they are no longer operational, because lithium batteries often contain enough residual charge [7].

Cases of BB ingestion may be difficult to distinguish from the more common coin ingestions. Plain radiographs of the chest and abdomen should be ordered urgently and examined carefully for the and the "stepoff" sign on lateral views and the double halo sign on anteroposterior views, which help distinguishes the offset poles of a BB from coin FB ingestion. Endoscopic removal may be difficult if there is adhesion of the battery to the mucosa because of the caustic injury. A "rat tooth" designed removal forceps can often successfully grasp the stepoff between the 2 poles of the battery for retrieval. Alternatively, a retrieval net may be effective also. In patients in whom the BB's

adherence to the mucosa does not permit removal by flexible endoscopy, use of a rigid endoscope by surgery or otolaryngology may be necessary, although this may substantially increase the risk of perforation [7].

The opportunity window for injury-free removal of an esophageal BB is less than two hours, which is considerably shorter than reported in past, most probably related to the greater voltage and capacitance of the lithium cell. Delays introduced by late or incorrect diagnosis, late presentation, limited access to expert endoscopy consultation, referral to a tertiary care facility, or concern about inducing anaesthesia after eating certainly contributed to the severity of complications. Anticipating delayed hemorrhage on the basis of BB position and degree of injury, performing serial diagnostic tests, prolonging in-hospital observation for patients who are at risk, and prompt intervention when bleeding develops may prove life-saving. Specific clinical recommendations on the basis of burn severity and location needs to be developed, which address issues like frequency of imaging or endoscopy, hospitalization duration, interval of feeding initiation, and the use of steroids and antibiotics [6].

Although outcome is determined by battery diameter and chemistry, these parameters are initially unknown in more than 4 out of 10 cases.

An urgent initial radiograph is required for most BB ingestions, but the requirement is waived in asymptomatic ingestions of less than or equal to 12 mm BBs in patients who are older than 12 years, because significant complications are unlikely. The 12-mm cut-off captures most ingested BBs. In contrast, younger children always require an immediate radiograph to exclude an esophageal BB, even when asymptomatic, because 36% of patients with batteries lodged in the esophagus were initially asymptomatic [6].

General anaesthesia may be required for BB removal in pediatric age group. If battery is in esophagus, AP and lateral views should be ordered and examined to determine the negative pole orientation [8].

Batteries that are in the esophagus must be removed within 2 hours. Batteries that are in the stomach or beyond in an asymptomatic patient should be left to pass spontaneously, with inspection of the stool or possible repeat radiograph in two weeks to confirm its passage. A magnet co-ingested with the button battery should be promptly removed.

Patients younger than 6 years who have ingested

≥15-mm batteries should have another radiograph 4 days after ingestion to confirm that the battery has moved beyond the stomach and should be removed with endoscope if it is still in the stomach. Earlier endoscopic retrieval is indicated when any symptoms are evident, because it may indicate gastric ulceration or previously undetected esophageal lodgement of the button battery [6].

Radiographs should be examined for the battery's halo effect or double-rim on anteroposterior radiograph or step-off effect on the lateral view, to make sure the "coin" or an "ECG electrode" is not really a BB. Endoscopic removal of esophageal BB is crucial to anticipate complications and determine the esophageal injury extent [8].

While performing endoscopy one should avoid pushing an esophageal battery into the stomach, as the chances of esophageal perforation risk increases.

Complications should be anticipated on the basis of injury location and structures that are adjacent to the hydroxide-generating negative pole. Tracheoesophageal fistulas and aorto-esophageal fistula can occur even after removal and present later. On the basis of injury severity and location, the clinician must determine the length of observation, duration of the esophageal rest, and the need for serial imaging or endoscopy/bronchoscopy. Early intervention must be performed in patients who are at risk of perforation into major vessels [6].

## Conclusion

Button battery ingestion is a life-threatening emergency especially if impacted and if the alkali gets leaked which can cause necrosis and perforation of the gastro-intestinal tract. This gets more complicated if the ingestion is not witnessed and missed as seen in our patient. This is very rare to see a button battery impaction for a prolonged period with no serious complications. Our patient presented with non-specific complaints which did not suggest any foreign body ingestion and was being managed conservatively for upper respiratory infection but on high suspicion CXR was done followed by detailed enquiry of history which revealed a possible button battery ingestion. This was confirmed after endoscopic retrieval of the foreign body. The primary aim of publishing this article is to make the emergency physicians aware of such a delayed presentation of a prolonged impaction of button battery in esophagus without any life threatening complications. We should keep a low threshold for CXR or other investigations

if the child does not look normal even with a vague history.

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