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IP International Journal of Forensic Medicine and Toxicological Sciences

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Case Report

Button battery ingestion- case report and review

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ARTICLE INFO

Article history:
Received 02-07-2020
Accepted 07-09-2020
Available online 31-10-2020

Keywords:
Button battery
Children
Hematemesis
Esophagus
Blood clots

ABSTRACT

Over the last few years there is a rise in use of button batteries in various toys and other electronic gadgets. Easy availability and small size of these batteries pose a significant risk of ingestion in small children. Button battery ingestion can lead to serious health hazards very rapidly. A 2-year-old girl presented to the emergency room of a community hospital complaining of hematemesis. X-ray showed a coin lithium battery located in the esophagus, and she was transferred to a referral hospital and succumbed to death after 4 hours survival in king george hospital. Postmortem examination revealed massive blood clots in stomach.

1. Introduction

Battery ingestion in children is an emerging hazard. With the use of button batteries in toys and easy accessibility to these batteries, the incidence of accidental ingestions is increasing.[1]

Coin battery ingestion is potentially life threatening for children. Aortoesophageal fistula and hemorrhage are most common cause of death in children who have swallowed coin batteries, and there have not been any reported survivors.[2,3]

Around 70% events occurred in children less than 6 years of age and 21% events occurred in children between 6 and 19 years.[4] Though the incidence of manganese dioxide, zinc air, mercuric oxide, and silver oxide ingestion is coming down, there has been a steady rise in the incidence of lithium battery ingestion.

2. Case Report

A 2 year child presented with vomiting of blood. Parents took him to Local CHC. X-ray of chest was taken and found a coin sized foreign body in esophagus (Figure 1) and referred to our hospital and succumbed to death after 4 hours admission. Case was registered under section 174Cr.P.C by police and body was sent for post mortem examination.

On external examination, Length – 82cms, moderately built, moderately nourished (Figure 2). Hospital plaster marks on right soft cheek. Injection marks on front of right elbow and back of right hand. ECG lead marks on front of chest. Both eyes closed, conjunctivae pale.

On internal examination, all organs are grossly pale and normal weight to the age (Figure 3). A button battery of 2cm diameter and 3mm thickness noted 8cm above the level of gastro-oesophageal junction (Figures 4 and 5). On removing object mucosal surface of corresponding esophagus eroded with zone of hyperaemia around (Figure 6). 560grams of blood clots and blood present in stomach and proximal duodenum (Figure 7). On washing the blood clots, mucosa was normal (Figure 8). Cut section of lungs exuding copious froth (Figure 9).

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https://doi.org/10.18231/j.ijfmts.2020.025

Opinion regarding cause of death "HAEMORRHAGIC SHOCK SECONDARY TO BUTTON BATTERY INGESTION".

Fig. 1: Showing foreign body in esophagus

Fig. 2: External appearance

3. Discussion

The esophagus is a 25-cm long(in adults) muscular tube that connects the pharynx to the stomach·The length of the esophagus at birth varies between 8 and 10 cm and measures about 19 cm at age 15 years. Three normal anatomical constrictions where esophageal blockade is common.

Fig. 3: Showing Organs Pale

Fig. 4: Showing button battery insitu

Coin batteries are specially designed for a wide variety of small appliances, such as hearing aids, watches, remote controls, and toys. The dissolving of a battery's active ingredients within the upper aero-digestive tract is associated with a strong exothermal reaction within the tissue, causing severe mucosal and full-thickness injuries.[5] Catastrophic and fatal injuries can occur when the battery

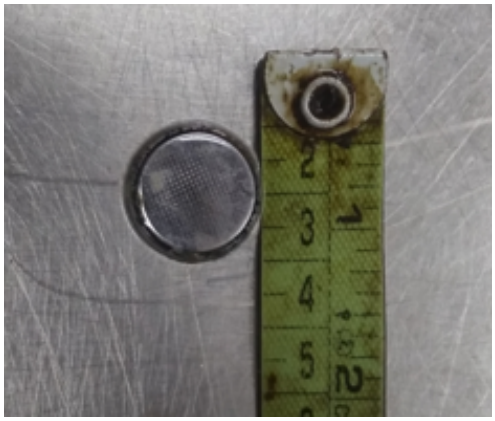

Fig. 5: Showing measurements of removed button battery

Fig. 6: Showing eroded esophagus with hyperemia

becomes lodged in the esophagus, where battery-induced injury can extend beyond the esophagus to the trachea or aorta. Increased production of larger, more powerful button batteries (BBs) has coincided with more frequent reporting of fatal hemorrhage secondary to esophageal battery impaction.[6]

The mechanism of injury of esophageal battery impaction is electrochemical. Esophageal tissue traverses the positive and negative electrodes, which lie in proximity. The flow of electricity then leads to pH changes in surrounding tissue.[6]

Complications of button battery lodged in esophagus include mucosal burns, perforations, stricture, vocal cord paralysis, formation of tracheo-esophageal fistula, major hemorrhage & death[7].

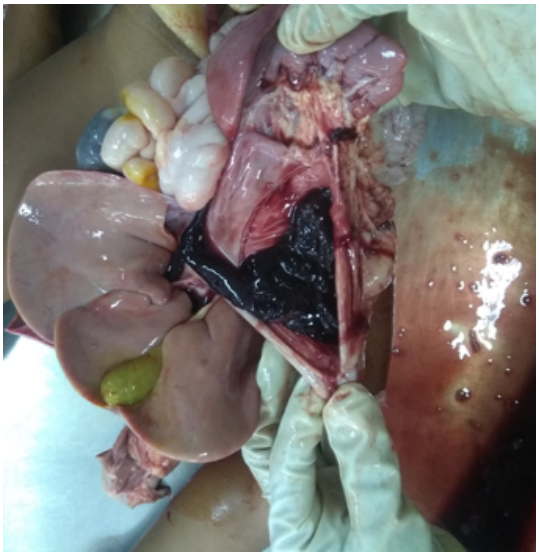

Fig. 7: Showing antemortem blood clots in stomach

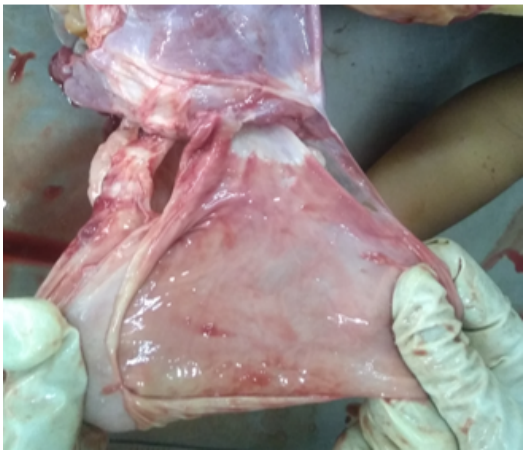

Fig. 8: Showing normal stomach wall after removing blood clots

Fig. 9: Showing froth on cut section of lungs

3.1. Is Lithium battery dangerous than any other foreign body?

1. A button battery can fuse to the mucosa rapidly, leading to difficult removal that may require rigid esophagoscopy[8].
2. These coin-size lithium batteries possess a strong electrical charge when out of the electronic unit. If swallowed by children, they become lodged in the upper esophagus and react quickly with saliva. The battery discharges a current that hydrolyzes water and generates hydroxide, creating a caustic (alkaline) injury to the tissue. Serious damage like liquefactive necrosis and perforation occurs in just two hours.
3. Surrounding tissue injury can occur in just 2 hours by several mechanisms:

- When placed in a conductive medium, a button battery gives rise to an external current, causing electrolysis of tissue fluids and the generation of hydroxide at the battery's negative pole;
- Leakage of alkaline electrolyte from the battery causing liquefactive necrosis;
- Pressure necrosis.

Recent evidence points to the first mechanism as the most important cause, especially for 20-mm lithium batteries which generate more current because they have twice the voltage and higher capacitance compared with other button batteries

Even after passage of the battery to the stomach, necrosis of the esophagus and surrounding tissues is an ongoing process that can lead to fistulization and associated severe outcomes.

Some Myths and Facts about button batteries[9]:

1. Myth: Button batteries often develop a leak, which leads to tissue injury
   a. **Fact:** Leaks usually do not occur. Instead an electrical and chemical reaction takes place at the anode surface, which creates tissue erosion.
2. Myth: A "dead" battery cannot injure children if ingested
   b. **Fact:** A battery below 3 volts power may not be able to run an electronic device, but it still can cause tissue erosion in less than two hours.

4. Conclusion

Battery ingestion injury may become a social hazard, so parents and childcare providers should be taught to prevent battery ingestion. Since majority of batteries ingested by children are obtained from electronic devices, manufacturers should redesign household products to secure the battery compartment, possibly requiring a tool to open it. In our opinion, this problem needs to be addressed by manufacturers of electronic products, who should better secure the battery compartments, not just in toys but in all devices.

To conclude, early diagnosis of ingestion of button battery is important to avoid life-threatening complications. Presence of battery in esophagus is an emergency. Parents, primary health care workers, and pediatricians need to be educated about the hazards related with button battery ingestion. Moreover, we need to have data on the incidence and complications in India. This would help us to formulate better management strategies and reduce morbidity.

5. Source of Funding

None.

6. Conflict of Interest

None.

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Cite this article: Rao PVR, Pedada RK, Sekhar VC, Kumar PA. Button battery ingestion- case report and review. *IP Int J Forensic Med Toxicol Sci* 2020;5(3):107-110.