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## Gastric Mucosal Damage From Ingestion of 3 Button Cell Batteries

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Management of ingested button batteries, according to recently updated recommendations from the National Capital Poison Center, is based primarily on symptoms and where the batteries lodge. Batteries in the esophagus can cause life-threatening or even fatal complications including esophageal perforation (1,2), tracheo-esophageal fistulas (3,4), and hemorrhage from arterial fistulization (8). Injury is thought secondary to electrochemical burns from electrical discharge. Chemical burns from electrolyte alkali leakage and pressure necrosis also may contribute (5). Early endoscopic removal from the esophagus is thus advocated.

In contrast, management when button batteries have passed the lower esophageal sphincter is less clear. Few cases of injury have been reported from button batteries distal to the esophagus (6,7). Indications for removal are not fully delineated.

We report a case in which 3 ingested button batteries were removed from a young child's stomach. Significant mucosal injury was found in the gastric body despite early intervention. Further information is needed to determine the clinical conditions under which button batteries lodged in the stomach warrant early extraction.

### PATIENT PRESENTATION

A previously healthy 15-month-old boy presented after being found by his father with a new toy that was missing previously attached batteries. Forty-five minutes before presentation, the patient was found by his father playing with a new toy. Spare batteries included with the toy were missing. Suspecting ingestion, his parents brought him immediately to the emergency department (ED). Before arrival in the ED, he had a brief bout of crying followed by emesis, which contained food but no blood or batteries. History suggested that ingestion was no more than 1.5 hours before presentation because the parents identified a 45-minute window in which the child had access to the toy but was not under their direct supervision.

Medical history and review of systems were unremarkable. After the emesis, he was in no pain or discomfort. He had no cough, drooling, dyspnea, or dysphagia.

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Physical examination revealed a well-nourished boy in no acute distress. He was afebrile with normal vital signs and 96% oxygen saturation. Neck was supple with no crepitus. Auscultation of the lungs was unremarkable. His abdomen was full and soft with no distension or tenderness to palpation. Bowel sounds were normal.

Abdominal radiograph revealed 3 radioopaque disks in the stomach (Fig. 1). Identical batteries supplied by the parents were AG13 manganese-dioxide alkaline batteries with a potential of 1.5 V at full charge, diameter 11.6 mm, and thickness 5.4 mm.

We extracted the batteries endoscopically under general anesthesia. The esophagus showed no mucosal injury. Upon entering the stomach, partially digested food was seen. Approximately 100 mL of water jet was used to agitate the gastric contents and visualize all 3 batteries, which were in the body near the antrum, along the greater curvature. A fishnet snare was used to capture and extract each battery. On gross examination, all 3 batteries were corroded with brown discoloration and chemical odor. The batteries were extracted within 4 hours from the earliest possible time of ingestion.

After battery extraction, we observed black and green necrotic tissue underlying the area where they had rested (Fig. 2). No active bleeding was identified. The necrotic area was locally immobile during peristaltic movements of the surrounding stomach wall.

The patient was admitted for observation and started on acid suppression. He received intravenous hydration with nothing by mouth for 24 hours. He remained asymptomatic. On hospital day 2, he tolerated diet advancement and was discharged home on a proton pump inhibitor.

## DISCUSSION

The present case demonstrates relatively rapid gastric mucosal injury following button battery ingestion. With our patient's ingestion of low-voltage batteries, symptoms limited to 1 bout of emesis, and location of batteries in the stomach, conservative management with home observation would have been acceptable by current standards (8). We elected endoscopic removal based on the multiple batteries, the patient's young age, and his relatively low risk with anesthesia. The significant gastric mucosal damage observed upon endoscopy suggests that this more aggressive approach could be warranted in certain cases.

Investigators from the National Capital Poison Center recently updated management guidelines for button battery ingestion. They based their recommendations on analyses of cases reported to the National Battery Ingestion Hotline from 1990 to 2008, the National Poison Data System 1985 to 2009, and a comprehensive literature review (8,9). Factors previously associated with clinically significant outcome have included battery diameter 20 to 25 mm (odds ratio [OR] 24.6;  $P < 0.001$ ), age younger than 4 years (OR 3.2,  $P < 0.0001$ ), and ingestion of more than 1 battery (OR 2.1,  $P = 0.02$ ) (10). The authors recommend removal of esophageal batteries within 2 hours of ingestion because severe burns and sequelae have been observed with longer time frames. For button batteries in the stomach on radiographs, they recommend observation, with endoscopic removal only if symptoms develop. Their guidelines do not specifically address how to approach ingestion of multiple batteries.

Although our patient's only symptom was 1 emesis, we observed necrotic mucosa, a finding associated with more severe outcomes in caustic ingestions (10). One case has been reported in which battery fragmentation in the stomach developed on day 2 after ingestion and necessitated surgical intervention (6).

Risk factors in the present case included more than 1 battery ingested, which may have allowed a parallel configuration with higher overall voltage, young age, and emesis. Minimal time elapsed between ingestion and extraction. The batteries were medium-size magnesium dioxide batteries, deemed low risk per previous reports. Although the batteries appeared somewhat corroded, no fragmentation was noted. Nevertheless, even under these relatively favorable circumstances, we witnessed gastric mucosal injury.

Endoscopic techniques and tools and risk containment in anesthesia have evolved significantly during the last 2 decades. Earlier reports document success in only 46.7% of attempts to remove batteries distal to the esophageal sphincter, although many of the failures were secondary to batteries passing beyond the stomach (11). Fast retrieval time and improved endoscopic tools may now contribute to improved retrieval rates.

The long-term implications of necrotic mucosal injury cannot be dismissed without adequate data, especially in young children. Long-term sequelae include impaired gastric emptying and strictures. In particular, such sequelae are difficult to evaluate in epidemiological studies, which have provided the only firm guidance on this general subject to date (9,11). The lodging of batteries near our patient's antrum may have increased risk for these complications had the batteries remained and injury progressed. Previous epidemiologic studies have associated lodging of batteries in the stomach, versus more distally with more severe corrosion and worsened outcome (11).

Our case suggests that removal of intragastric button batteries may be warranted if multiple batteries are present in a young child and anesthesia risk is low. If batteries are not removed, then educating the family about symptoms suggestive of late complications remains extremely important. Long-term follow-up of children with button battery ingestions with and without extraction would be helpful in solidifying management guidelines.

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## References

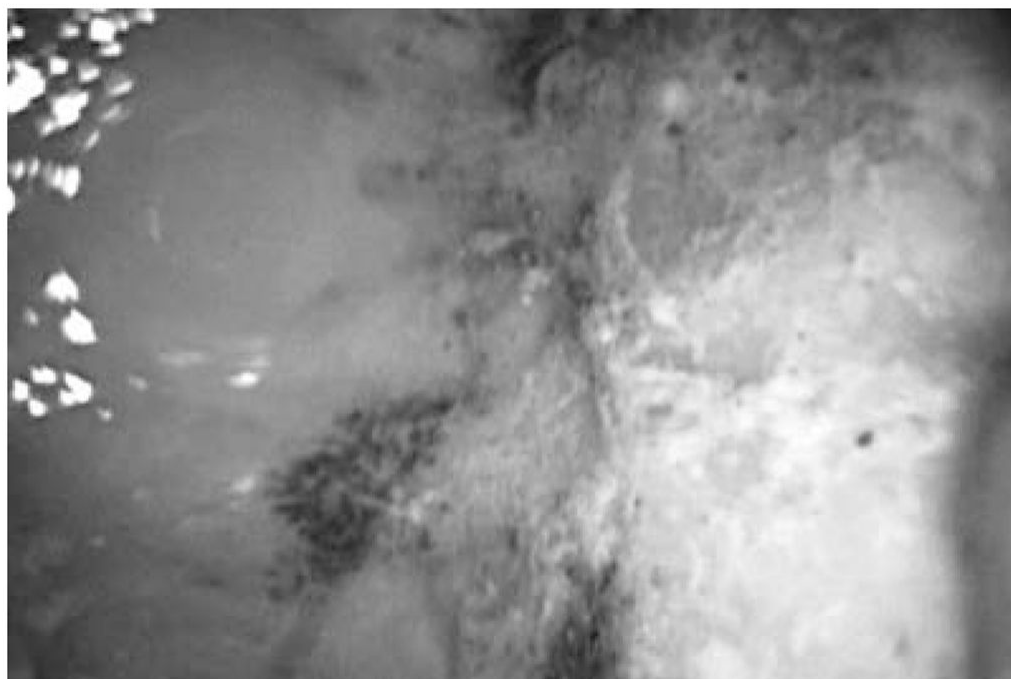
1. Samad L, Ali M, Ramzi H. Button battery ingestion: hazards of esophageal impaction. *J Pediatr Surg.* 1999; 34:1527–31. [PubMed: 10549763]
2. Soerdjbalie-Maikoe V, van Rijn RR. A case of fatal coin battery ingestion in a 2-year-old child. *Forensic Sci Int.* 2010; 198:e19–22. [PubMed: 20181450]
3. Votteler TP, Nash JC, Rutledge JC. The hazard of ingested alkaline disk batteries in children. *JAMA.* 1983; 249:2504–6. [PubMed: 6842753]
4. Slamon NB, Hertzog JH, Penfil SH, et al. An unusual case of button battery-induced traumatic tracheoesophageal fistula. *Pediatr Emerg Care.* 2008; 24:313–6. [PubMed: 18496117]
5. Kost KM, Shapiro RS. Button battery ingestion: a case report and review of the literature. *J Otolaryngol.* 1987; 16:252–7. [PubMed: 3309361]
6. Temple DM, McNeese MC. Hazards of battery ingestion. *Pediatrics.* 1983; 71:100–3. [PubMed: 6848955]
7. Chang YJ, Chao HC, Kong MS, et al. Clinical analysis of disc battery ingestion in children. *Chang Gung Med J.* 2004; 27:673–7. [PubMed: 15605907]
8. Litovitz T, Whitaker N, Clark L, et al. Emerging battery-ingestion hazard: clinical implications. *Pediatrics.* 2010; 125:1168–77. [PubMed: 20498173]
9. Litovitz T, Whitaker N, Clark L. Preventing battery ingestions: an analysis of 8648 cases. *Pediatrics.* 2010; 125:1178–83. [PubMed: 20498172]

10. Rigo GP, Camellini L, Azzolini F, et al. What is the utility of selected clinical and endoscopic parameters in predicting the risk of death after caustic ingestion? *Endoscopy*. 2002; 34:304–10. [PubMed: 11932786]
11. Litovitz T, Schmitz BF. Ingestion of cylindrical and button batteries: an analysis of 2382 cases. *Pediatrics*. 1992; 89(4 pt 2):747–57. [PubMed: 1557273]



**FIGURE 1.**

Thoracic and abdominal x-ray obtained upon presentation to emergency department. Three radioopaque disks consistent with button batteries visible in the stomach. No free air appreciated.



**FIGURE 2.** Stomach greater curvature, following battery removal. Areas of dark discoloration represent necrosis.