# Button Battery Ingestion in Children

## A Paradigm for Management of Severe Pediatric Foreign Body Ingestions

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**KEYWORDS**

• Button battery ingestion • Aortoesophageal fistula • Gastrointestinal hemorrhage
• Pediatric • Foreign body ingestion • Caustic ingestion • Esophageal stricture • MRI

**KEY POINTS**

- Button battery ingestions are the most dangerous form of foreign body ingestion commonly encountered in pediatrics.
- A multidisciplinary approach is needed to most effectively manage these patients, including emergency medicine, anesthesia, pediatric gastroenterology, pediatric surgery/cardiothoracic surgery, otolaryngology, interventional cardiology, and radiology.
- Even after removal of the battery from the esophagus, there may be ongoing evolution of the injury for up to several weeks thereafter, placing patients at risk for a catastrophic aortoesophageal fistula or other severe sequelae.
- Endoscopic intervention for asymptomatic gastric button batteries remains controversial but may be considered in high-risk patients in order to evaluate for esophageal injury.
- Surveillance of esophageal injury with MRI may be used to stratify the risk of severe hemorrhage and guide management decisions.

## INTRODUCTION

Management of foreign body ingestion (FBI) can be one of the most challenging issues in pediatric endoscopy. The myriad variations in size, type, and timing of foreign object ingested, compounded by patient factors, such as age, underlying medical issues, and clinical presentation, make each case inherently unique. Button battery (BB)

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ingestions (BBIs) epitomize the challenge of pediatric FBI, as the outcome can range from harmless to death. As the authors' center has personally experienced, when death occurs as a consequence of BBIs in an otherwise healthy child, it is one of the most tragic occurrences that a physician may encounter in a career.

US surveillance data have demonstrated a clear increase in morbidity and mortality due to BBI in the last 2 decades,[1,2] fueling public health and advocacy efforts to broadcast the danger of BBs for small children. The urgency to endoscopically remove esophageal batteries is now well appreciated, but further consensus on management has been difficult to develop.[3–5] From the clinical standpoint, there are 2 specific areas of management where there is considerable controversy and/or ambiguity. First is the postremoval management of children with moderate/severe esophageal injury. Clinicians must first appreciate the spectrum of esophageal and para-esophageal complications associated with BBI in children and the specific management dilemmas encountered. The risk for delayed occurrence of aortoenteric fistula (AEF) days or weeks following BB removal[3] further challenges our decision making, specifically around patient disposition after battery removal.

The second controversial area in the management of BBI surrounds the management of asymptomatic patients with batteries beyond the esophagus (eg, intragastric, duodenal, and so forth). Recent expert opinion-based guidelines from the Endoscopy Committee of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN) recommended consideration of endoscopic assessment and removal in certain cases of BBI whereby the battery lies beyond the esophagus.[5] This recommendation contradicts previous guidelines from the National Battery Ingestion Hotline (NBIH) and the National Capital Poison Center, which had suggested only conservative initial management in asymptomatic children with postesophageal BB.[1,6] In this article, the authors review their single-center experience with BBI with the primary aim of presenting data that may help better inform and support management decisions.

## BACKGROUND

Ingestion of batteries has long been recognized as a potential health hazard for children.[7,8] Voluntary reporting data, as collected through the NBIH and National Poison Data System since the 1980s, has revealed several important trends in the epidemiology of BBI.[9] Although the rate of battery ingestion (per million population) has remained stable in children over the past 30 years,[1] data from the National Electronic Injury Surveillance System has shown the absolute number of emergency department (ED) visits for battery-related injury has more than doubled from 1990 to 2009.[2]

More concerning, the rate of significant complications and death resulting from BBI has increased almost 7-fold.[1] This emergence of greater BBI-associated morbidity and mortality appeared in the mid 1990s and temporally corresponds to a change in battery production toward larger-diameter, higher-voltage lithium cells. The composition of swallowed batteries has subsequently trended toward larger-diameter lithium batteries, as these are now ubiquitous in the household environment.

More than 90% of serious outcomes from BBI in children between 2000 and 2009 were due to greater than 20-mm diameter lithium cells.[1] Because of its size, the 20- to 25-mm diameter lithium BB is more likely to become impacted in the pediatric esophagus compared with the traditional, previously standard, less than 15-mm alkaline BB. Serious outcomes are most common in small children less than 5 years of age.[9] Small children are more likely to mouth objects in the environment, and the smaller diameter of the esophagus in young children predisposes to foreign body