

## A Modern Pediatric Emergency: Ingestion of Lithium Button Batteries

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### Abstract

The miniaturization of batteries over the late 20<sup>th</sup> century has unleashed a dangerous addition to the problem of foreign body ingestion. There are now over 3,000 annual button battery ingestions in the United States in those under 6 years of age. These disk or lithium batteries may become caught in the esophagus with potential dangers and even death to the child. Such foreign body ingestions are typically not witnessed and suspicion should be raised in any clinician seeing a child with recent emergence of cough, dysphagia, and/or drooling. It should be considered an emergency and immediate radiographic evaluation conducted. Delay in diagnosis can lead to calamitous consequences for this toddler.

**Keywords:** *Ingestion; Lithium Button Batteries*

### Introduction

Foreign body ingestions (FBIs) have been a well-known and serious problem for children since the beginning of human beings. In 1999, the American Association of Poison Control (AAPC) noted 182,105 episodes of FBIs by persons under 20 years of age with over 1,500 deaths [1,2]. The AAPC reported that three-quarters of the more than 116,000 FBIs in 2000 were found in those 5 years of age or younger [3]. Ingestion objects in children are typically small plastic toys, coins, and other small objects.

As batteries became smaller and more widespread in the late 20<sup>th</sup> century, reports starting in the late 1970s began to emerge of children swallowing hearing aid batteries and mercury batteries [4-6]. As button (disk; lithium) batteries became more widespread in the late 20<sup>th</sup> century, reports of ingestion of these batteries by children appeared in the medical literature [7].

### Button Battery Ingestions (BBIs)

In 1983, a review was published of 56 cases of button battery ingestions that identified the potential for esophageal dislodgement and gastrointestinal erosions [7]. The ubiquitous exposure of children to small lithium batteries in the 1980s and 1990s led to increasing more literature about the potentially tragic phenomenon in small children [8-10].

Button battery cells of the early 21<sup>st</sup> century may contain various metals including cadmium, mercury, or lithium. Lithium button batteries are small batteries used to provide power to pacemakers, hearing aids, wrist watches, toys, and many other objects. Their popularity had resulted in over 3,000 button (disk; lithium) battery ingestions each year in the United States that mainly are swallowed by those under 6 years of age; also, there has been more than 6-fold increase in these ingestions from 1985 to 2009 [11,12].

### BBI Complications

Complications of button battery (lithium) ingestions are worse for children under age 4 years of age who swallow a battery 20 mm or larger [12]. Research notes that 12.6% of children who ingest a 20 mm battery develop severe injuries that sometimes results in the death of the child [13].

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The danger of lithium batteries is that its contact with the esophagus can result in an electric current involving leakage of sodium hydroxide that can damage the esophagus via liquefaction necrosis within 2 or 3 hours and injury to blood vessels in proximity to the contact [14]. Damage to the esophagus can lead to trouble swallowing, tracheoesophageal fistula formation, and development of an aorto-esophageal fistula with major hemorrhaging aorto-esophageal fistula leading to death of the child [15-22].

### **BBI Symptomatology**

Clinicians must be very vigilant about the possibility of a button battery ingestion in small children. Most ingestions are not witnessed and their exact timing is difficult to pinpoint. The diagnosis is tragically missed if clinicians do not think of it when seeing a young child (or older as well including the elderly) who develops unexplained crying, irritability, fever, cough, dysphagia, and/or drooling [23].

Aspiration of button battery is rare. Of a series of 348 cases, 3 were lodged in the nasopharynx and only one in the lower airways [23]. The reason might be the small size of the airways in children. Nevertheless, significant injury of the upper airways and lower airway can occur in cases of ingestion including: vocal cord paralysis, aspiration pneumonia, tracheoesophageal fistula, mediastinitis, pneumothorax and long term airway stricture. [24-26].

### **BBI Evaluation and Management**

The clinician must first think of the possibility of a BBI and treat this as an emergency in a child [13]. A vigorous and rapid plan must be developed to identify if there is an ingestion and where it is dislodged [13,20,27,28]. Radiography is immediately done of the neck, chest, and abdomen in attempts to locate the foreign body. Waiting in this regard is not an option and delay in diagnosis with management can lead to more esophageal damage with fistula formation, hemorrhage, and death.

If the battery lodges in the esophagus, a chest x-ray will demonstrate a radiopaque round object with a classic halo sign or step-off appearance having a ring around the button battery disc's outer edge [14,29]. Exact management that focuses on removal of the lithium battery in the esophagus depends on many factors and should be handled by experts in pediatric gastroenterology, pediatric pulmonology, and pediatric emergency medicine- depending the details of each situation [13,20,27,28].

However, the first step in this situation is to immediately recognize the possibility of a BBI in the child no matter who the clinician is, whether a primary care clinician or specialist, start with emergency radiography and proceed depending on the basis of this initial evaluation [13,27,29,30]. Lithium battery ingestions are a serious 21<sup>st</sup> century emergency damaging far too many of our precious children [31].

### **Conclusion**

Foreign body ingestion of a lithium button (disk) battery is an emergency that should be suspected in any child who develops recent and unexplained cough, dysphagia, and/or drooling. Such ingestions are usually not witnessed and thus, clinicians must have a high index of suspicion for this modern phenomenon. Damage to the esophagus can lead to trouble swallowing, tracheoesophageal fistula formation, and development of an aorto-esophageal fistula with hemorrhaging leading to death of the child in rare but tragically preventable circumstances. Immediate radiography is needed with x-rays of the neck, chest and abdomen. Management is dependent on the timing of this ingestion, when it is found, what damage has occurred and the age of the child. Delay in its diagnosis is dangerous and potentially deadly for this child.

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