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CLINICAL RECORD

Accidental button battery ingestion presenting as croup

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Abstract

Objectives: To report a case of misdiagnosis of an impacted oesophageal button battery in a child, and to describe the associated risk factors for impaction and the management of such cases.

Case report: An 18-month-old, otherwise fit and well child with stridulous respiration was initially treated for croup. Medical treatment over the course of three months failed, and appropriate imaging subsequently demonstrated an impacted button battery in the upper oesophagus. This was promptly removed. There were no signs of damage on direct visualisation, or on a follow-up contrast swallow image.

Conclusion: This case highlights the difficulty of diagnosing oesophageal foreign bodies. We also discuss the characteristics of button batteries which confer a greater risk of impaction, and the associated sequelae and complications.

Key words: Child; Esophagus; Foreign Bodies; Endoscopy; Complications

Introduction

Accidental ingestion of button batteries by children is occurring more frequently, and has potentially severe and sometimes fatal consequences.[1] Once impacted, a battery can rapidly cause local damage, with onset of necrosis and subsequent damage to surrounding structures, and sequelae including strictures, fistulation and perforation.[2,3] The impaction of a button battery can also present with respiratory symptoms, including those associated with croup.

The presented case demonstrates how ingestion can present in this latter way, which may lead to a potentially fatal delay in treatment. This case also highlights important factors in cases of button battery ingestion, including predictors of poor outcome such as: a large, lithium-containing battery; young patient age; and long duration of impaction.[4]

It is estimated in the US that the incidence of button battery ingestion is between 2 to 8 per million annually.[5] There was a 6.7-fold increase in ingestions leading to major or fatal outcomes, comparing 1985 and 2009 figures.[6] Fortunately, most cases of button battery ingestion are clinically uneventful, and 90 per cent pass through the digestive tract spontaneously.[7]

A policy of conservative management is usually adopted for smaller, asymptomatic ingestions, due to this spontaneous passage.[1] However, those button batteries that impact within the oesophagus can result in serious and sometimes fatal complications.[1,4,6] Intervention is required for batteries lodged in the oesophagus, in patients with local symptoms or other gastrointestinal symptoms.[1] Methods for removal include induced muscle relaxation, magnet retrieval,[8] Foley catheter trawling,[9] rigid or flexible oesophagoscopy, and open surgery.

Due to the increasing incidence of button battery impaction, much work has been done in order to define distinct risk factors and develop clinical protocols.[5] In this report, we describe a novel scenario of a symptomatic, chronically impacted oesophageal button battery in a young child presenting solely with respiratory symptoms mimicking croup.

Case report

An 18-month-old child was referred to the paediatric emergency department. Having been previously well, she had developed a three-month history of stridulous inspiration and wheeze following a choking incident prior to this. Initial consultation with her general practitioner had resulted in a diagnosis of croup, but the child's symptoms were refractory to steroid treatment.

A chest X-ray revealed a circular, 20 mm opacity within the oesophagus at the level of the first and second thoracic vertebrae. The 'halo' (also known as 'double-density') and 'step-off' signs were both visible, suggesting the presence of a button battery (Figures 1 and 2).[10,11] At this stage, a surgical referral was sought. A careful history revealed that the child had developed a gradual onset of dysphagia to solids.

Rigid bronchoscopy and oesophagoscopy were promptly performed, and an intact button battery (CR2016 type, 20 mm diameter, 3 V, lithium cell) was retrieved from the superior third of the oesophagus (Figures 3 and 4). Signs of battery corrosion were evident, as well as mucosal oedema and irregularity. A direct visual assessment for tracheoesophageal fistula was undertaken but this was not detected. The concluding diagnosis was an impacted oesophageal button battery indenting the trachea anteriorly and causing airway compromise.

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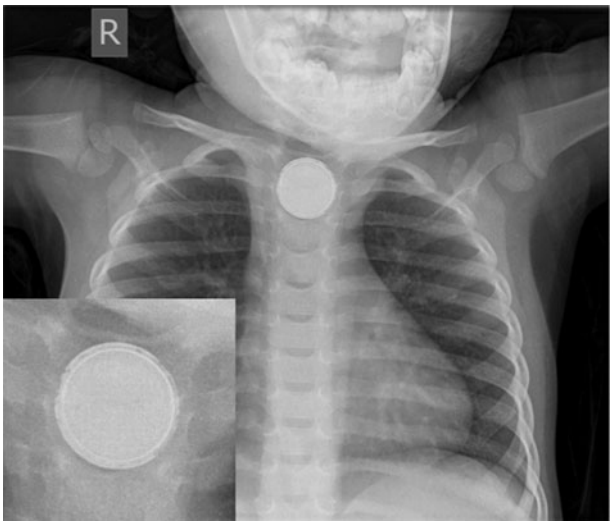


FIG. 1
Frontal soft tissue chest X-ray taken on presentation, demonstrating the battery in the upper oesophagus. Inset shows magnified detail of the battery, demonstrating the 'halo' sign and corrosion of the casing. R = right

A course of corticosteroids and antibiotics was initiated. On day three, a normal upper-gastrointestinal contrast study excluded fistulation and occult perforation (Figure 5). The child was discharged on day four.

At two-month review, she was noted to be feeding well. A repeated contrast imaging study excluded delayed stricturing and was otherwise unremarkable.

Discussion

The incidence of button battery ingestion is increasing. The healthcare community needs greater awareness of this event in order to facilitate correct diagnosis and management.

Button batteries are both small and powerful and are thus used widely around the household, including in numerous children's toys. They come in a variety of diameters: for example, from 9.5 to 30 mm for lithium cells. Yardeni *et al*. define large batteries as those greater than 15 mm in diameter, with a peak of incidents occurring with batteries of 20–23 mm diameter, due to the symptoms and sequelae of impaction.[4] The prevalence of ingestion of 20–25 mm batteries has increased greatly between 1990 and 2008, from 1 to 18 per cent, respectively.[6] Twenty millimetre cell batteries have been associated with the most severe outcomes, due to acute burns. Smaller batteries tend to be ingested more frequently but also to pass spontaneously.[1]

The voltage of these batteries ranges from 1.5 to 3.0 V when new. It has previously been shown in animal models that 3.0 V lithium batteries are associated with greater injury than the more frequently used 1.5 V cells.[12] This association has also been observed in cases of human ingestion.[1]

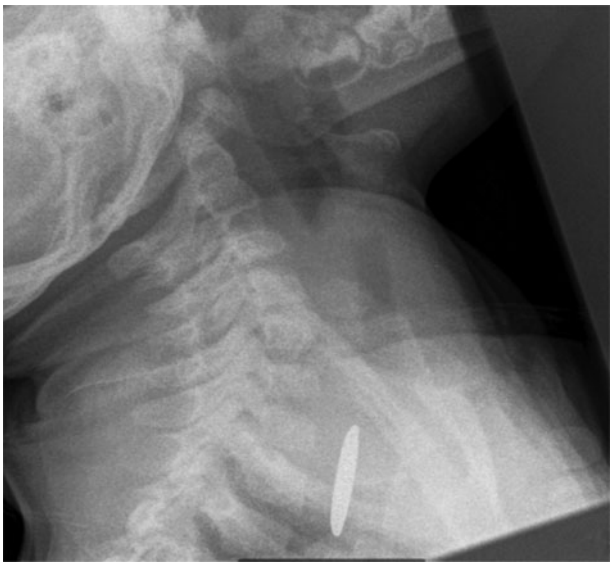


FIG. 2
Lateral soft tissue neck X-ray showing the impacted button battery.



FIG. 3
Oesophagoscopic view showing the impacted button battery.



FIG. 4
Clinical photograph showing the retrieved button battery (a CR2016 type, 3 V, 20 mm diameter, lithium battery).

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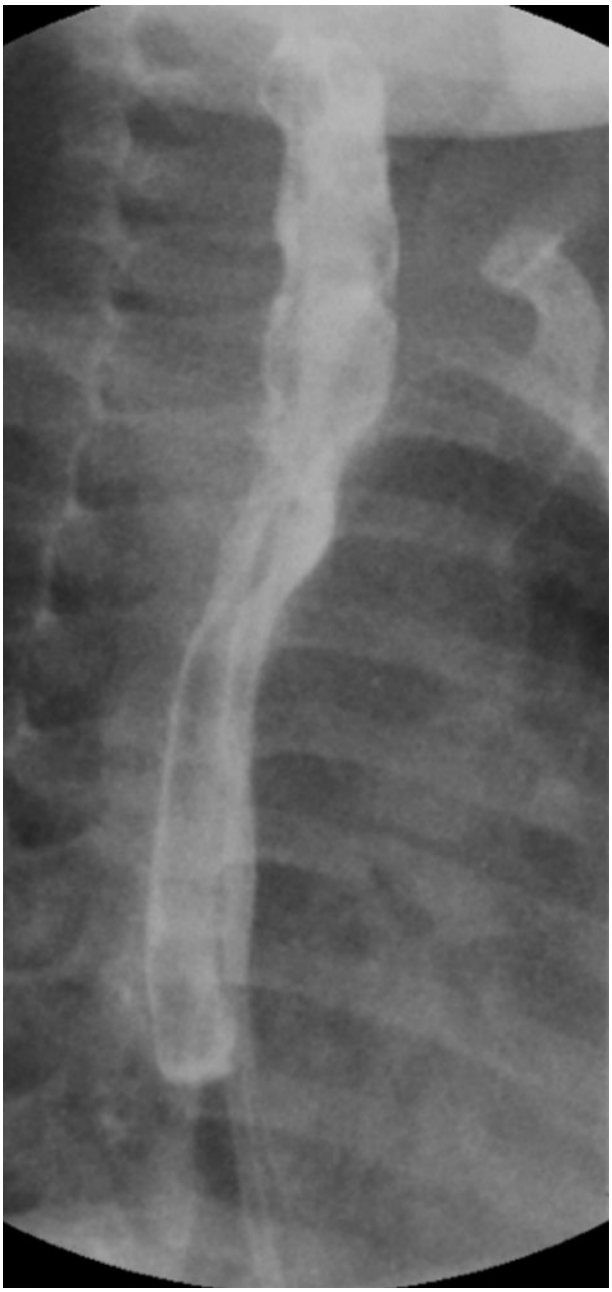


FIG. 5
Upper gastro-intestinal contrast X-ray study performed on day three, showing a normal appearance.

There are four distinct types of disc battery, depending on the chemical composition of the cell: mercury, manganese, silver and lithium.[8] Lithium batteries are usually implicated, as in our case. They also tend to be larger and of greater voltage. Mercuric oxide batteries have a greater tendency to fragment. Previous cases of raised urinary mercury levels following battery ingestion have been documented, but are uncommon.[13,14] One known case of renal failure following ingestion has been reported.[15]

The duration of impaction is a predictor for risk of serious complications. Early studies on animal models showed mucosal damage and ulceration within 2 hours, with a seemingly intact battery. In human cases, burns at 4 hours and perforation at 6 hours have been described.[1] In our patient, the degree of damage was fortunately minimal on examination and imaging.

Batteries are biologically unsealed and readily discharge their contents in moist environments. They pose the threat of damage through various mechanisms: (1) leakage of alkali, causing direct caustic injury to the mucosa; (2) tissue absorption of toxic substances; (3) pressure necrosis; and (4) external electrolytic current causing hydrolysis of tissue fluid and production of hydroxide at the cathode.[6,14,16] Therefore, batteries must be promptly removed.

- **Button battery impaction within the oesophagus can be a difficult diagnosis**
- **Children can present with croup-like symptoms**
- **The 'double-density' and 'step-off' radiological signs indicate a button battery**
- **Wrongly ascribing radiological findings to an inert object (e.g. coin) risks significant morbidity**
- **Local damage occurs within hours, so emergency removal is needed**

Complications of button battery ingestion vary in severity. Initially, mucosal damage and burns may occur.[1] Cases of subsequent oesophageal perforation have also been reported, usually treated conservatively rather than surgically.[3,16] Other reported complications include: oesophageal strictures; tracheoesophageal fistulation; aorto-oesophageal fistulation associated with major haemorrhage; aspiration; Meckel's diverticulum perforation; vocal fold paralysis; and death.[2,5,6,17,18] Given these risks, our patient was observed following removal, with a contrast swallow imaging study on day three.

Due to the risks associated with prolonged impaction of an ingested battery, it has been recommended that they be removed within 2 hours. The use of emetics and cathartics has been reported as ineffective, and the assessment of blood and urine mercury levels unnecessary. Endoscopic removal from the oesophagus is preferable as this enables direct visualisation of any injury (as opposed to Foley catheter trawl or magnet retrieval). Special attention should be paid to the mucosa facing the negative pole of the battery (i.e. the narrower end, without an imprint) as this pole causes greater direct damage.[6]

Conclusion

A button battery impacted within a child's oesophagus can be a difficult diagnosis, and can present with croup-like respiratory symptoms. However, the radiological double-density and step-off signs indicate the presence of a button battery. Wrongly ascribing such radiological findings to a coin or other inert object risks significant morbidity for the patient.

Local damage can occur within hours of battery impaction, so removal should be undertaken as an emergency, without delay.[19–21]

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