Button battery injury in children—a primary care issue?

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ABSTRACT

There is a well-described increase in the incidence of significant injury associated with button batteries in children. Button battery ingestion or insertion (ear/nose) is a time-sensitive injury mechanism, with severe injury occurring within hours.

Prevention efforts are being developed that may include changes to packaging, public awareness campaigns, safe disposal mechanisms, changes to battery design and changes to device design. However, there is not a single, simple and effective prevention strategy available.

This community hazard has significant implications for primary care. This article presents the clinical characteristics and epidemiology of button battery exposure and subsequent injury. It also describes the clinical recommendations, specifically an emphasis on early diagnosis, including maintaining a high index of suspicion; rapid removal where possible or urgent referral for operative intervention.

KEYWORDS: Burns, chemical; child, preschool; infant; foreign bodies; thoracic injuries

Introduction

Button battery injury following ingestion or insertion is a hazard for small children around the world. This article describes these injuries, presenting the clinical picture, the epidemiology and science, the prevention of such injuries and detailing the important role of primary care teams in minimising the harm that can rapidly follow ingestion or insertion of a button battery.

Case review

The cases presented are composite case examples from several different hospitals. They do not present or identify individual patients.

Case 1

A 22-month-old child presented to the family doctor with a history of vomiting ‘green stuff’, refusing to eat and intermittent irritability. He was afebrile and appeared systemically well. He was referred to hospital in view of his persistent vomiting.

On review in the emergency department, he had ongoing vomiting and irritability and a gastrointestinal cause was thought most likely. The child had normal observations, was afebrile and had a ‘soft’ abdomen. Urinalysis revealed a normal urine. As intussusception was considered in the differential diagnosis, an abdominal ultrasound was performed, which was normal. The child was then found to settle following some simple oral analgesia and was noted to be eating biscuits. The child was admitted for observation and the next day was noted to have grunting respirations. A chest x-ray was then completed, which revealed a foreign body in the distal oesophagus (Figure 1). The patient was referred to paediatric gastroenterological surgery and the paediatric surgeon promptly operated to remove the button battery endoscopically (Figure 2). An oesophageal burn, identified at surgery, subsequently healed without further incident.

Case 2

A four-year-old boy presented to a general practitioner (GP) with predominantly right-sided nasal
discharge for several months. He had sought medical attention for this nasal discharge on at least two previous occasions and had been discharged with antibiotics, which had resulted in only very short-term improvement. Pain was not noted to be a significant feature of this presentation.

The GP identified a foreign body in the right nostril that was not able to be removed in the surgery. The child was referred to the emergency department where the foreign body was seen on visual examination of the nostril. In view of its atypical appearance and position, an x-ray was performed. This revealed a button battery sitting almost in the midline.

The child was taken to theatre by the otorhinolaryngology service who removed the battery after clearing secretions and necrotic tissue. A large septal perforation was evident, with significant cartilaginous destruction noted. It is anticipated that the child will require a number of procedures to improve the functional and cosmetic outcome from this injury.

Discussion

Incidence and science

Exploration of the magnitude of this problem in New Zealand is hampered by coding issues. Battery ingestion or insertion is not coded separately in hospital separation data and is not recorded separately by the New Zealand Accident Compensation Corporation (ACC).

An audit of Starship Children’s Hospital presentations over the period March 2009 to March 2012 has recently been completed.^ Potential cases were identified using a text search of triage and discharge diagnosis for the term ‘battery’ and inpatient discharge coding for ‘Foreign Body’ (International Classification of Diseases, Tenth Revision, Clinical Modification [ICD-10-CM] diagnosis codes T16 to T18). The clinical records of all of these potential cases were then reviewed by a single researcher, identifying 61 patients who presented with a button battery-related problem. The mean patient age was three years and 57% of patients were male (n=35). More than half of the injuries (n= 31, 51%) occurred via ingestion (swallowed), and the most common site was the stomach (n=19, 31%). The next most common sites were: mouth-only exposure (n=3, 5%), ear canal insertion (n=3, 5%) and nasal cavity insertion (n=8, 13%). Review of the clinical outcomes of these patients revealed that 26% (n=16) required overnight admission and 28% (n=17) required surgery. The majority of patients did not sustain significant injury (n=52, 85%). However, six patients sustained moderate but non-permanent injury and three patients sustained severe permanent injury. The mean length of stay at the hospital was 245 minutes.
With initial clinical reports arising in the 1980s, an increasing incidence of severe button battery injury has been noted across the world. This increase has coincided with the increasing availability of devices that are operated by these batteries; the development of more powerful, lithium-containing batteries; and by the larger size of these batteries (particularly greater than 20 mm).

The mechanism of injury is primarily related to the generation of an external electrolytic current that hydrolyses tissue fluid, producing hydroxide at the negative pole of the battery. When a battery is lodged in one location, this can rapidly result in significant mucosal damage and deep tissue burns. Severe burns have occurred in less than three hours in some cases. Most severe injuries and deaths result from erosion through the oesophageal wall, followed by development of a trachea-oesophageal fistula or an aortic fistula. Injury manifestations can present weeks after battery removal, due to fistulas or delayed perforation.

The risk of severe injury is increased by a longer duration of exposure to the battery, exposure to higher battery voltages (including new versus a used battery), larger size of the battery (risk of oesophageal lodgement and higher voltage), and younger age of the child (size and communication issues).

**Prevention**

A number of areas of prevention are being investigated and implemented. However, it is clear to injury prevention workers that there is no rapid or simple solution to this injury mechanism. In the USA and Australia, a public awareness campaign has been launched as a collaboration between Energiser and Safekids/Kidsafe Australia. A similar public awareness campaign is planned for New Zealand, coordinated by Safekids New Zealand.

Modifications to packaging and labelling have been undertaken by some manufacturers; however, this is far from universal. There are a range of device retailers and battery manufacturers and importers that provide button batteries to the New Zealand market place. It has been identified that this is a difficult area to regulate and that battery disposal is also an issue.

Battery modifications are being considered by manufacturers and researchers. This could include modifications to make the battery less likely to generate current in the human body, modifications to the battery to allow for easier x-ray identification, or modifications to the battery to allow caregivers to identify exposures earlier (coloured saliva/secretions). However, it is clear that these modifications are neither simple to design nor implement and are therefore not likely to reduce injury in the near future.

**Implications for primary care**

Button battery ingestion or insertion results in a time-sensitive injury, usually to children under five years of age, with rapid removal of the battery required to prevent tissue necrosis. Primary care practitioners have a key role in the reduction in injury severity related to button battery exposure. Most children will present to primary care, and diagnosis, removal and referral are required rapidly. The possibility of button battery ingestion or insertion should trigger a rapid response from all involved in the delivery of health care, including telephone advice lines, reception staff, practice nurses and doctors.

This is an important clinical problem that is increasing in incidence and is likely to continue to increase over the next few years as the prevalence of high voltage button batteries increases.

The recommendations outlined in the following sections reflect the consensus view of the authors.
(paediatric emergency and paediatric surgical clinicians) based on personal experience and current literature.

Diagnosis
A high index of suspicion is required to diagnose button battery ingestion or insertion. Often children are preverbal or are very reluctant to describe the event. There may be no history of exposure, or children may deny exposure, even when there is x-ray evidence.

Identification of a metallic foreign body in the nose or ear should be considered to be a button battery unless clearly identified as another object. An x-ray should be considered when a patient presents with persisting nasal discharge, particularly if unilateral.

Ingestion of a button battery should always be investigated with an x-ray, even if asymptomatic. This will allow confirmation of ingestion, as well as identification of the location of the battery in the gastrointestinal tract. Depending on local access to x-ray, the timeliest method of investigation may involve referral to hospital prior to x-ray confirmation.

X-ray identification of a circular metallic object in the oesophagus should be regarded as a button battery unless there is a very clear history of coin ingestion.

Button battery ingestion must also be considered when children present with more non-specific symptoms, such as drooling, reduced oral intake, irritability, or respiratory symptoms, such as grunting or coughing with feeding.

Time-critical removal or referral
If a button battery (or the possibility of it) is identified in an ear or nose, this should be urgently removed. If this is not possible in the primary care setting, then immediate referral to a facility with otorhinolaryngology availability should occur.

Identification of an oesophageal button battery or a history consistent with this diagnosis should result in immediate referral to the nearest hospital with the capacity to remove the battery, ideally by a gastroenterology surgeon.

The management of button batteries that have reached the stomach is somewhat controversial; however, most practitioners would ensure the button battery had passed the pylorus by following the progression radiologically. A discussion with the closest paediatric surgical referral centre is recommended.

Conclusion
Child injury due to exposure to button batteries is increasing, due to the increasing prevalence of these batteries, their physical size and their voltage. Despite efforts by industry, public health groups and consumer regulators, no simple solution is in sight. Injuries from button batteries can be severe and can occur within hours. Identification of exposure is difficult and management is time critical.

Primary care providers have a vital role in the dissemination of information to caregivers, early identification of cases (including a high index of suspicion with regard to oesophageal ingestion and nasal insertion), and rapid removal or urgent referral for removal.

References

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Competing Interests
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