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Button Battery Ingestions

By Amberly R. Johnson and Shayley East Godfrey

Introduction

More than 3,500 people swallow button batteries each year in the United States.[1] A button battery is a single-cell miniature disc battery used to power common electronic devices including, but not limited to, remote controls, calculators, watches, hearing aids, handheld games, clocks, and key chains.[2] When ingested, most small button batteries pass through the GI tract without adverse consequences. However, ingestion of larger button batteries (≥ 20 mm in diameter) is more likely to result in significant adverse effects, including death.[3] The National Poison Data System (NPDS) shows a dramatic increase of button battery ingestions associated with severe clinical outcomes since 2005.[3]

Proper diagnosis and prompt treatment are essential in preventing serious injuries related to button battery ingestions. The National Battery Ingestion Hotline (NBIH), established in 1982 by the National Capital Poison Center, collects data on button battery ingestions and has published guidelines for the triage and management of button battery ingestions.[3,4] Prevention strategies decrease the number of button battery ingestions and their severe outcomes.

Epidemiology

Reported button battery ingestions have increased over the past two decades, as well as the number of US emergency department visits related to these ingestions. Nationwide, 745 button battery ingestions were reported to NPDS in 1985 compared to

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the 3,366 reported in 2013.[5] Overall, 70,378 button battery ingestions were reported to NPDS from 1985-2013; 68% of these ingestions occurred in children < 6 years of age.[5] Based upon data from the National Electronic Injury Surveillance System (NEISS), the number of battery-related emergency department visits in US children <18 years of age increased from 2,591 visits in 1990 to 5,525 visits in 2009.[6] Utah Poison Control Center also observed similar trends in button battery ingestions. Of the 822 button battery ingestions reported between July 1, 1997, and October 16, 2013, to the Utah Poison Control Center, 75 ingestions occurred in 2012 compared to 26 ingestions in 1998.

Major and fatal outcomes associated with button battery ingestions have been reported. Of the reported button battery ingestions to NPDS from 1985 to 2013, major effects occurred in 176 cases.[5] Major effects are defined by NPDS as "symptoms as a result of the exposure, which were life-threatening or resulted in significant residual disability or disfigurement." Through NPDS and published literature, NBIH has identified 39 deaths related to button battery ingestions. Twenty-two of these deaths have occurred since 2010.[7]

Of the 39 reported deaths related to button battery ingestions, 72% occurred in children ≤2 years (range 7 months to 5 years) and 46% of these were in males.[7] When chemistry and size were known, lithium ion button batteries ≥20 mm in diameter were implicated in a majority of deaths. These 3 V lithium batteries are used most commonly in households. In all reported deaths, the button battery was either retrieved from the

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Pediatric Marijuana Exposures

As of January 2015, 23 states and Washington, DC, have passed legislation allowing medical marijuana.[1] Washington and Colorado have also decriminalized small amounts of recreational marijuana, and voters in Oregon and Alaska passed similar laws to go into effect in 2015. Not only is marijuana available in plant form, but many edible forms such as gummy bears, chocolates, cookies, and beverages are being produced. Edible products are often indistinguishable from non-marijuana-containing foods. These can be very attractive and tasty to small children. In a case series of 14 toddlers in the Denver area exposed to marijuana products, two required admission to the ICU, including one for respiratory depression.

A recent study, published in the Annals of Emergency Medicine in June 2014, reviewed the American Association of Poison Control Centers National Poison Data System to determine the impact of legalization and decriminalization of marijuana on the pediatric population.[2]

Over a seven-year period, 985 exposures were reported in children nine years and younger. The majority of children showed clinical effects lasting fewer than 24 hours, with 2.7% of the cases lasting longer. The most common effects were neurologic, such as drowsiness, lethargy, ataxia, agitation, and confusion. Vomiting and respiratory depression were also seen in a few cases.

The rate of marijuana-related calls to poison centers in states that have not approved marijuana legalization or decriminalization did not change during the study period. However, in states that enacted permissive legislation, marijuana-related calls to poison centers increased by 30.3%. Most exposures occurred at home and were a result of ingestion. The clinical effects in cases in decriminalized states were more severe, with 18.9% admission to a health care facility versus 13.6% in non-decriminalized states. The authors postulate that this is likely due to the fact that edibles have a higher concentration of the active ingredient tetrahydrocannabinol (THC). Manufacturing practices for marijuana products are not standardized, and packaging has no weight or content amount for THC, which complicates the management of exposure cases.

While the overall number of pediatric exposure cases to date is low, the rate of these exposures is increasing significantly. The best prevention strategies as legalization occurs in multiple states are adoption of child-resistant packaging, opaque packaging that the child can't see into, larger warning labels, and targeted public education for parents and caregivers of young children.

[1] http://medicalmarijuana.procon.org//view.resource.php?resourceID=000881

[2] George S. Wang, Genie Roosevelt, Marie-Claire Le Lait, et al. Association of Unintentional Pediatric Exposures With Decriminalization of Marijuana in the United States, *Annals of Emergency Medicine,* Jun 2014; 63(6): 684-689. http://dx.doi.org/10.1016/j.annemergmed.2014.01.017.

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Button Battery

esophagus, or esophageal injury was described. Common patient complications reported included fistulas (aortoesophageal, tracheoesophageal, esophageal-carotid, and/or vasculoesophageal), esophageal tears and/or perforations, and massive bleeding including exsanguination.[7]

Mechanism of Injury

The most significant mechanism of injury occurs from the accumulation of hydroxide ions at the negative pole of the button battery.[8] The negative pole of a button battery is described as the narrow or "step off side" of the battery and is opposite the + sign (and often the imprint code) on the battery. Typically, larger button batteries are of higher voltage and generate more current. Electrical current produced by the button battery flows through tissues adjacent to the negative pole of the button battery and hydrolyzes water, leading to the formation of hydrogen gas and hydroxide ions. The resultant hydroxide ions cause tissue liquefaction and necrosis, similar to that of an alkaline caustic injury.[3,8]

Pressure necrosis is also a possible mechanism of injury and is most likely to occur in batteries with a >15-20 mm diameter.[8] Larger batteries tend to become lodged in the esophagus leading to direct contact with the esophageal tissue. Pressure alone does not generally lead to extensive tissue damage; however, it may potentiate the other harmful effects of the button battery ingestion.[8]

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M-44 Sodium Cyanide

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Bureau of Wildlife Services would like us to remind you that the M-44 sodium cyanide device is used in Utah. The ejector device contains a capsule of sodium cyanide, which is baited with meat and placed in the ground. This device is used in specific situations to control coyotes, red foxes, gray foxes, and wild dogs to protect livestock and endangered species and to prevent the spread of disease. This device is primarily used on private lands but may also be used on federal land in any county in the state. Areas where the M-44 sodium cyanide device is used are marked with signs. While human exposure to this device is extremely unlikely, be aware this device contains 91% sodium cyanide for which there is an antidote. Please report any exposure to this device to the Utah Poison Control Center at 1 (800) 222-1222.

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Button Battery

Clinical Presentation

Initial symptoms associated with button battery ingestions are non-specific and include coughing, gagging, drooling, decreased appetite, and irritability.[2] A majority of button battery ingestions will present asymptomatic.[9] Tissue damage occurs rapidly and is seen as early as two hours post-ingestion.[2,11] Delayed complications of button battery ingestions include esophageal fistulas, perforations, and strictures; vocal cord paralysis; tracheal stenosis; aspiration pneumonia and lung abscess; spondylodiscitis; and death.[2]

Diagnosis

Prompt diagnosis and emergent endoscopy to retrieve esophageal batteries can prevent death and reduce the severity of the outcomes. When caretakers do not witness the event, button battery ingestions can be difficult to diagnose because symptoms are non-specific.[3] Healthcare providers should be aware of the potential for battery ingestion even when the event is not witnessed. In 13 reported fatal cases from 2002-2010, four patients were misdiagnosed and released, delaying treatment.[10]

The National Battery Ingestion Hotline recommends considering the possibility of button battery ingestion in every patient with a foreign body ingestion presumed to be a coin, as well as when presented with the following symptoms:[3,11]

- Airway obstruction and wheezing
- Chest pain or discomfort
- Drooling and difficulty swallowing
- Vomiting and abdominal pain
- Decreased appetite or refusal to eat
- Coughing, choking, or gagging with eating or drinking

X-ray imaging of the abdomen, esophagus, and neck is needed for diagnosis and confirmation of the location of the button battery.[3] On anterior-posterior x-ray, a button battery may appear double-ringed or have a "halo effect." On a lateral x-ray, a "step off" or more narrow side of the battery may be noted. The NBIH guidelines recommend an immediate X-ray to locate the battery if the patient is symptomatic or the following are true[3,11]

- The patient is ≤12 years old.
- The patient is >12 years and the battery is >12 mm or an unknown size.

Treatment

Treatment of button battery ingestion involves the immediate removal of the battery from the esophagus by endoscopy.[3,11] Assess the surrounding tissue for mucosal injury, and anticipate delayed complications based upon the location and severity of the injury. Patients will require long-term follow-up to further assess for long-term complications such as esophageal perforations, fistulas, and strictures, which may take weeks to months to develop. For button batteries located on x-ray in the stomach or beyond, asymptomatic patients may be managed at home, with precautions to return if abdominal pain or bloating occurs as these may indicate intestinal obstruction. Surgical removal may be warranted if the button battery causes an obstruction or does not pass in the stool.[3,11]

Prevention

To prevent ingestion and serious injuries related to button battery ingestions, increasing awareness about the dangers of button batteries could prevent ingestion and serious injuries related to these ingestions. According to NBIH data, 61.8% of ingested batteries were most often obtained directly from the product by the child, 29.8% were loose or discarded, and 8.2% were obtained from battery packaging.[2] Check all household devices containing button batteries for child-resistant locking mechanisms.[12] If a device does not have a child-resistant locking mechanism, secure the device with strong tape and keep out of reach of children. Store spare batteries out of reach of children and in a location where they will not be mistaken for food and/or medications. For adults, never test to see if a battery still has a charge by putting it on your tongue.[12]

Conclusion

Button battery ingestions and harm associated with these ingestions have increased dramatically over the last two decades. Proper diagnosis, triage, and treatment of patients may help reduce the incidence of severe injuries and deaths associated with button battery ingestions. Increasing public awareness of button battery ingestions may help decrease the number of ingestions. The Utah Poison Control Center is here to help. We are available for consultation regarding button battery ingestion at 1(800) 222-1222, 24 hours a day, 7 days a week.

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TOXINS IN THE NEWS

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Risk with topical teething anesthetic agents

In 2011 the FDA warned about safety concerns related to methemoglobinemia following the use of over-the-counter topical benzocaine teething preparations.[1] Around the same time, many hospitals removed or restricted use of spray benzocaine solutions for numbing the mouth or throat, and last year the FDA cautioned against the use of oral lidocaine 2% solution for teething pain in infants and children. The FDA received 22 case reports of serious adverse reactions, including deaths, in infants and young children 5 months to 3½ years of age who were given oral viscous lidocaine solution for the treatment of mouth pain, teething, or stomatitis. A new Boxed Warning to this effect has been added to the drug label and package insert.[2] Some cases of excessive use in older children and adults have also resulted in death from arrhythmias.

Parents and caregivers should follow the American Academy of Pediatrics' recommendations for treating teething pain:

- Use a teething ring chilled in the refrigerator (not frozen).
- Gently rub or massage the child's gums with your finger to relieve the symptoms.

[1] http://www.fda.gov/Drugs/DrugSafety/ucm402240.htm

[2] http://www.fda.gov/Drugs/DrugSafety/ucm402240.htm

MEET THE UPCC STAFF

KEVIN MCFARLAND, PHARMD began working at the poison center in February of 2014. A native of Salt Lake, he completed a baccalaureate degree at the University of Utah in speech communication. After realizing he would rather work in a health science field, he went back to school, and in 2011 graduated from Skaggs School of Pharmacy at the University of Montana in Missoula (where he never once went fly fishing). After pharmacy school Kevin worked as a retail pharmacist in Idaho and Utah before joining UPCC. Kevin loves learning new things and is excited about working with UPCC since he gets to teach, and there is always something new to learn. Kevin is married, has three sons and three brothers. He enjoys movies, spending time with his family, and riding his recumbent bike. He is very interested in toxicology of biologicals like animals and plants.

UTAH POISON CONTROL CENTER STAFF

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**Certified Specialist in Poison Information*

THANK YOU

The Utah Poison Control Center expresses its sincere thanks to the health care professionals, public health officials, and toxicology colleagues that work together to treat and prevent poisonings.

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