Button Battery Ingestion

Introduction

Button batteries are small cell-type, disc-shaped batteries that differ in size, chemical composition, and voltage. They contain an anode and cathode. The anode is generally made of zinc or lithium; whereas the cathode is made of a plethora of chemicals (Table 1). Each disc battery has an imprint with one to two letters, and three to four numbers. The International Electrotechnical Commission sets each imprint to help determine the difference in each battery.

Button batteries differ in diameter and thickness. The imprint code can be found on the battery package and on the battery itself. The letter “R” is used to designate a round battery. The size of the battery can be important in evaluating the risk of the ingestion. Harmful outcomes are more common with ingestion of batteries with a diameter greater than or equal to 20 millimeters; approximately the same size as an American quarter. The nomenclature for lithium manganese dioxide batteries notes the diameter first in mm followed by the thickness. Diameter generally ranges from six to 25 mm and thickness from 12 to 77 mm. For example CR2032 has a diameter of 20 mm and a thickness of 3.2 mm.

National Battery Ingestion Hotline

The National Battery Ingestion Hotline (NBIH) at the National Capital Poison Center in Washington, DC, was established in 1982. The NBIH phone number is 202-625-3333. It is open 24 hours a day, seven days a week with trained professionals available to answer questions about button battery ingestions. The NBIH collects button batteries after ingestion to study decomposition.

Epidemiology

US Poison Control Centers through the National Poison Data System (NPDS) reported 56,535 button battery ingestions from 1985 to 2009, of which 68% occurred in children less than 6 years of age.

While there has been no demonstrated trend in reports of battery ingestions to US poison control centers, the proportion of cases resulting in a major or fatal outcome has risen nearly 7-fold over the last three years. A recent study published in Pediatrics reviewed available data from NPDS, NBIH and the literature to identify outcome predictors and trends. A total of 13 fatalities have been reported from 1977-2011 from battery ingestion, all in children under the age of three years. In 41 (56%) patients under the age of 10 years.

In 73 cases, 92% in children younger than 4 years and all occurring in children under the age of 10 years. In 41 (56%) patients the ingestion was not witnessed resulting in a delayed or missed diagnosis in 19 as a result of the non-specific symptoms and misidentification on radiograph. Severe esophageal burns and esophageal stenosis occurred in as little as 2.5 hours in three cases. Removal of the battery occurred within 24 hours in 50% of cases that resulted in a major outcome. Other significant clinical effects included tracheoesophageal fistulas, other esophageal perforations, esophageal strictures and stenosis, vocal cord paralysis, mediastinitis, cardiac or respiratory arrests, pneumothorax.
OUTREACH EDUCATION

CDC LAUNCHES NEW AWARENESS CAMPAIGN

Each year, more than 400 people die in the US from accidental carbon monoxide (CO) poisoning. CO is found in combustion fumes, such as those produced by small gasoline engines, stoves, generators, lanterns, and gas ranges; or by burning charcoal and wood. CO poisoning is increasingly recognized as a public health concern in the wake of large-scale disasters such as hurricanes, floods, and ice storms. Yet it is almost entirely preventable. With this increased awareness, the CDC has focused on surveillance, research, education, and partnerships as means to reducing mortality and morbidity from CO poisoning.

Using what was learned from its research activities and field investigations, CDC has developed an education strategy focusing on 3 key activities:

- A diagnostic tool for health professionals to assist in identifying CO poisoning in a clinical setting
- Maintenance of CDC’s CO web site, including CDC-TV features, print materials, public service announcements available for download, and CO poisoning prevention guidance in 17 languages
- Audience profiling for a proposed national communication effort to raise awareness of CO poisoning risks and preventive behavior

The campaign has been launched and all tools are available on the newly designed website: www.cdc.gov/co. Links to the research, surveillance, clinical guidance, prevention education, and partners are on the main website.

Tips to prevent CO poisoning:

- Have your heating system, water heater and other fuel burning appliances checked annually
- Install a battery-operated CO detector and check or replace the batteries twice a year
- Seek medical attention if you suspect CO poisoning and feel dizzy, light-headed, or nauseous - call the poison center at 1-800-222-1222
- Don’t use a generator or other fuel burning device in or near the home or garage
- Don’t run a car or truck inside a garage
- Don’t heat your home with a gas oven

TOXICOLOGY TODAY

A publication for Health Professionals.
SALICYLATE TOXICITY

by Andrew Dorias, MD
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The salicylate poisoned patient may be tachypneic, lethargic, comatose, seizing, hyperthermic, or in cardiopulmonary arrest. Arterial blood gas will likely reveal a mixed respiratory alkalosis and metabolic acidosis. Providers should have a low threshold to check a salicylate level on a patient that presents with any of the above signs or symptoms. A therapeutic salicylate concentration is 15-30 mg/dL. Salicylates have a narrow therapeutic window and toxicity can occur close to the upper limit of the therapeutic range. More than one salicylate level a few hours apart is required as delayed absorption can occur and a false sense of security is possible with an initially low blood concentration.

Once the diagnosis of salicylate toxicity is made initiate therapy with IV hydration and sodium bicarbonate. Three ampoules of sodium bicarbonate in one liter of D5 W at 200 cc/hr is a typical starting point for an adult. Patients who are acidic should receive a bicarbonate bolus of 1-2 mEq/kg. Alkalinizing the blood (pH 7.5) and urine (pH 8.0-9.0) traps the ionized form of the drug in these compartments. It is difficult to alkalinize the urine if a patient is hypokalemic as the kidneys will excrete hydrogen ions into the urine in an effort to retain potassium. Hence, administer potassium with the sodium bicarbonate infusion (20-40 meq/liter) unless the patient is in renal failure.

Frequent monitoring of arterial blood gas is necessary to detect systemic alkalosis.
If the patient is experiencing severe toxicity, one should consider hemodialysis. Indications are seizures, a salicylate concentration greater than 100 mg/dL, or a worsening acidosis in spite of treatment. Setting up for dialysis is often a cumbersome process involving multiple disciplines so consider this option early.

As a patient becomes increasingly acidic, salicylate more easily crosses the blood brain barrier, where it exerts toxic effects. This is why the patient’s respiratory drive is very important. A respiratory rate of 50-50 breaths/minute is not uncommon with severe toxicity and is a result of both the direct effect of the drug and a respiratory compensation to the developing anion gap metabolic acidosis. To take away the ventilatory drive can lead to sudden and severe acidemia and subsequent cardiovascular collapse. Thus, be careful intubating such patients for indications such as tachypnea and fear that the patient may tire. If intubation cannot be avoided, be sure to continue hyperventilating at a rate similar to the pre-intubation rate and check a blood pH 10-15 minutes later to access their acid-base status.

References

CARBON MONOXIDE TOXICITY AND HYPERBARIC OXYGEN THERAPY

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Carbon monoxide (CO) binds tightly to hemoglobin (Hgb) displacing oxygen and causing hypoxia and inflammation. The diagnosis can be made by measuring carboxyhemoglobin (COHgb) concentrations on blood gas analysis or with co-oximetry. It should be noted that standard pulse oximetry cannot distinguish between COHgb and O2 saturated Hgb. Patients can present with a variety of nonspecific complaints (e.g., headache, nausea, fatigue) and can have sequelae such as myocardial ischemia and delayed neurologic effects. COHgb has a half life of about 300 minutes while breathing room air. This decreases to 60-90 minutes with supplemental oxygen via a reservoir “nonbreather” apparatus, and to about 20-30 minutes with hyperbaric oxygen therapy. The use of hyperbaric oxygen for CO toxicity remains controversial as there is no definitive data that proves it prevents the delayed neurologic complications. Initial randomized controlled trials have produced conflicting results and have study design flaws. There is a lack of standardization among studies regarding duration, frequency, and intensity of treatment, as well as evaluation for cognitive delays.

The American College of Emergency Physicians Clinical Policy (2008) states that “hyperbaric oxygen remains a treatment option but its use cannot be mandated” based on current evidence. Patients at high risk should have early hyperbaric consultation, especially those with moderate to severe toxicity (seizure or syncope, coma, altered mental status or confusion, abnormal neurologic examination, COHgb >25%, fetal distress in pregnancy, or any signs of end-organ damage; myocardial ischemia, or pulmonary edema). The major absolute contraindication for hyperbaric therapy is an untreated pneumothorax.

TOXINS IN THE NEWS

- Quetiapine’s new drug label warns to avoid using it in combination with other drugs that may prolong the QT interval, including quinidine, procainamide, amiodarone, sotalol, other antipsychotic medications, certain antibiotics, pentamidine, levomethadyl acetate, and methadone.
- McNeil Consumer Healthcare announced it is “reducing the maximum daily dose of Extra Strength Tylenol to lower risk of unintentional overdose from acetaminophen”. It will list the maximum daily dose as six pills (3,000 mg) down from eight daily pills (4,000 mg).
- Inorganic mercury has been associated with “anti-aging”, “beauty”, and “skin lightening” cosmetic creams from foreign countries. Cases of toxicity have been reported.
a screwdriver to get into the battery compartment. Teach children that button batteries are not toys and should not be played with. Safety tips for button batteries can be found through the National Capital Poison Center’s NBIH website: www.poison.org/battery.

Conclusion

Button battery ingestion can produce significant morbidity and mortality within a short period of time and can range from no effects to esophageal perforation and death. Battery ingestion needs to be identified as quickly as possible and the size of the battery should be noted. The NBIH and poison control centers are available 24/7 to answer questions and concerns about button battery ingestion.

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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.