

**Texas Children's
Hospital**


Baylor
College of
Medicine

Beware the Double Halo The Dangers of Button Batteries

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Disclosures

- None


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Learning Objectives

- Identify the clinical symptoms and radiographic signs of button battery ingestion
- Rapidly formulate a plan for the patient with button battery ingestion



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22 m.o. female

- Increase in drooling over the past two days
- Occasional cough with eating
- Difficulty swallowing when eating
- Youngest of three



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Symptoms Can Include

- Airway obstruction or wheezing
- Drooling
- Vomiting
- Chest discomfort
- Difficulty Swallowing, decreased appetite, refusal to eat
- Coughing, choking, or gagging with eating or drinking

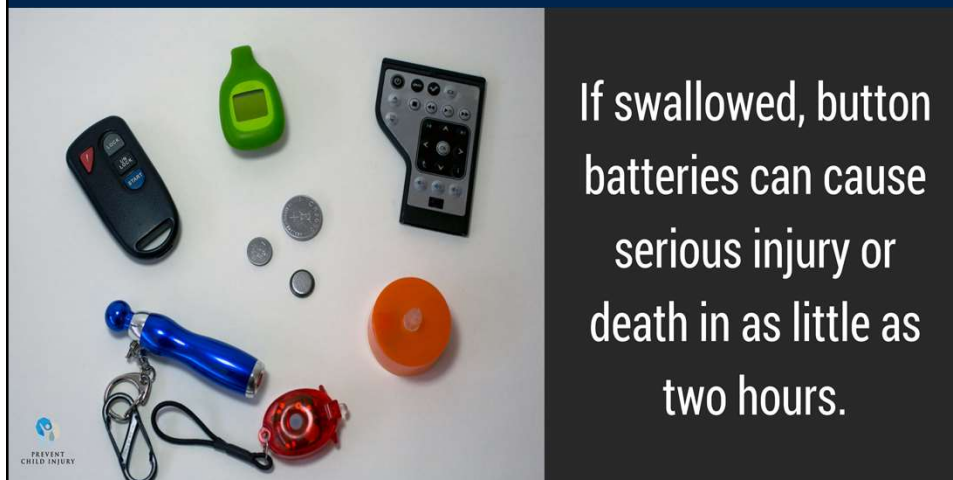
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NOTE:

- Patient may OR may not have an ingestion history

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Must rule out button battery ingestion



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Button Batteries

- A true emergency
- Serious sequelae include:
 - Esophagus - esophageal burn, perforation, fistula
 - Nose - damage to nose, nasal septum
 - Ear - TM perforation, EAC burn

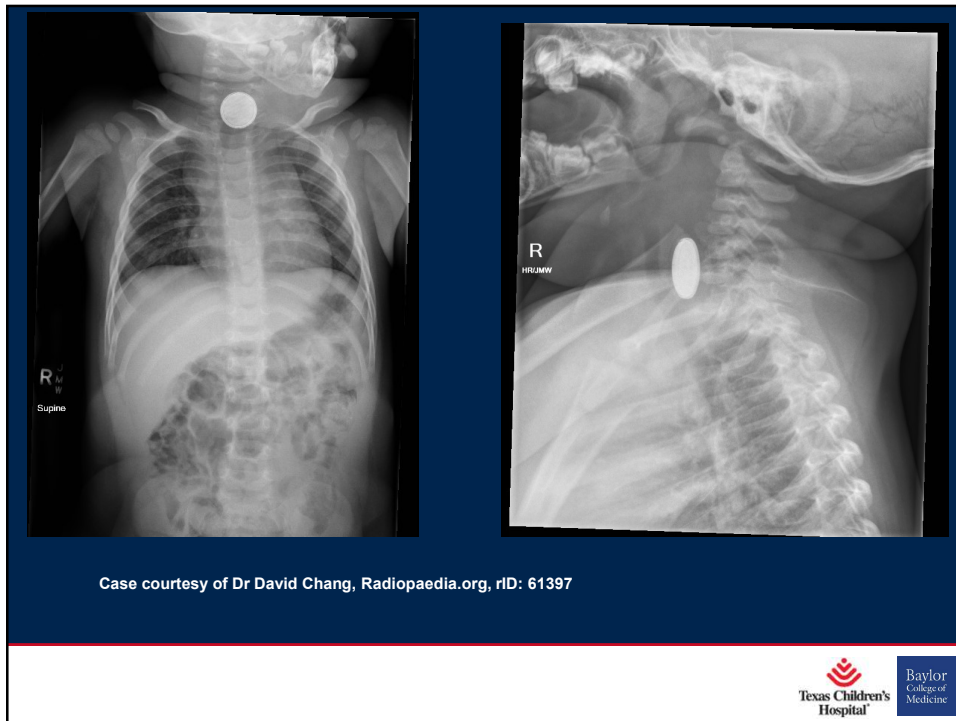
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Esophageal battery protocol

- > 3000 BB ingestions/year
 - 2006-2017: 6 fold increase in severe injuries; 12 fold increase in mortality
- Damage occurs in as little as 2 hours

Imaging

- Always get two view Xrays – AP and Lateral
- Flat surface of best seen on AP view when in esophagus
- Flat surface of best seen on Lateral when in trachea
- **Double Halo sign / Step Off sign = Button Battery**



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What is a button battery?

- 5mm – 25mm in diameter, 1mm – 6mm tall
- Stainless steel forms bottom body / positive terminal
- Metallic top – negative terminal
- Contents can include: zinc, lithium, manganese dioxide, silver oxide, carbon monofluoride, cupric oxide

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Methods of Injury

- Creation of electrical current that hydrolyzes tissue fluids and produces hydroxide at the battery's negative pole
- Leakage of battery contents (Esp. Alkaline electrolyte)
- Physical pressure on adjacent tissue



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Remember the 3 Ns

- Negative – Narrow – Necrotic
- The negative pole of the battery, which is the narrow side on the Xray, causes the most damage



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National Poison Control Button Battery Hotline

**Swallowed a battery?
Get help from the battery
ingestion hotline
immediately**

CALL 800-498-8666



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Poison Control Website

• www.poison.org/battery

POISON CONTROL
National Capital Poison Center

Get Help Online | webPOISONCONTROL | Poison Info | Statistics | Act Fast | The Poison F

Tips | Mechanism | Guideline | In the News | Severe Cases | Fatal Cases | Statistics

Swallowed a Button Battery? Battery in the Nose or Ear?

Every year in the United States, more than 3,500 people of all ages swallow button batteries. These are used to power hearing aids, watches, toys, games, flashing jewelry, singing greeting cards, remote control devices, and many other items. Call **800-498-8666** for guidance if someone swallows a battery.

Most button batteries pass through the body and are eliminated in the stool. However, sometimes batteries get "hung up," and these are the ones that cause problems. A battery that is stuck in the esophagus is especially likely to cause tissue damage. An electrical current can form around the outside of the battery, generating hydroxide (an alkaline chemical) and causing a tissue burn. When a battery is swallowed, it is impossible to know whether it will pass through or get "hung up."

If anyone ingests a battery, this is what you should do:

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Suspect a battery ingestion in these situations

- "Coin" ingested. Carefully check AP x-ray for battery's double-rim or halo-effect and lateral view for step-off. Use magnification.
- Symptomatic patient, no ingestion history. Consider battery ingestion if:
 - Airway obstruction or wheezing
 - Drooling
 - Vomiting
 - Chest discomfort
 - Difficulty swallowing, decreased appetite, refusal to eat
 - Coughing, choking or gagging with eating or drinking

Battery ingestion known or suspected

Give honey 10 mL every 10 mins if child < 12 months. Lithium coin can call possibly ingested, and ingestion within prior 12 hours. (See text guideline below for detail #2.) Do not delay going to ER to give honey. Otherwise, NPO until esophageal position ruled out.¹

Take up to 5 minutes to determine imprint code (or diameter) of coin or replacement battery.

Consult National Battery Ingestion Hotline at 800-498-8666 for assistance with battery identification and treatment.

TIPS, PITFALLS & CAVEATS

- 3 "N's": Negative – Narrow – Necrotic. The negative battery pole, identified as the narrowest side on lateral x-ray, causes the most severe, necrotic injury. The negative battery pole is the side opposite the "+" and without the imprint.
- 20 mm lithium coin cell is most frequently involved in esophageal injuries; smaller cells lodge less frequently but also cause serious injury or death.
- Definitive determination of the battery diameter prior to passage is unlikely in at least 40% of ingestions.
- Assume hearing aid batteries are < 12 mm.
- Manage ingestion of a hearing aid containing a battery as an ingestion of a small (< 12 mm) battery.
- Do not induce vomiting or give cathartics. Both are ineffective.
- Assays of blood or urine for mercury or other battery ingredients are unnecessary.

NOTES:

- NPO except for honey or sucralfate suspension.
- X-ray abdomen, esophagus and neck. Batteries above the range of the x-ray have been missed. If battery in esophagus, obtain AP and lateral to determine orientation of negative pole. If ingestion suspected and no battery visualized on x-rays, check ears and nose.
- If battery diameter is unknown, estimate it from the x-ray, factoring out magnification (which overestimates diameter).

Flowchart Logic:

- Battery in Esophagus?**
 - YES:** Immediately remove batteries lodged in the esophagus. Consider sucralfate suspension or honey if < 12 h post ingestion (see text guideline below for detail #1). Do not delay removal if patient has eaten. Prefer endoscopic removal (instead of removal by balloon catheter or magnet affixed to larynx for direct visualization of larynx injury. Inspect mucosa for extent, depth and location of damage. Note position of battery and direction negative pole faces. If no endoscopic evidence of perforation, irrigate injured areas of esophagus with 50-150 mL 0.25% sterile acetic acid to neutralize residual alkali (see text guideline below, #13a).
 - NO (Battery in stomach or beyond):**
 - Was a magnet co-ingested?**
 - YES:** Do not wait for symptoms. Remove endoscopically if possible, surgically if not.
 - NO:** Are related signs or symptoms present?
 - YES:** Manage patient at home. Regular diet. Encourage activity. Confirm battery passage by inspecting stools. Consider x-ray to confirm passage if passage not observed in 10-14 days. If symptoms develop later, promptly re-evaluate.
 - NO:** > 15 mm cell ingested by child < 6 years?
 - YES:** X-ray 4 days post ingestion (or swallow). If still in stomach, remove endoscopically (even if asymptomatic).
 - NO:** After removal, if mucosal injury was present, observe for and anticipate delayed complications: tracheoesophageal fistula, esophageal perforation, mediastinitis, vocal cord paralysis, tracheal stenosis or tracheomalacia, aspiration pneumonia, emphysema, lung abscess, pneumothorax, spondylodactylitis, or exsanguination from perforation into a large vessel. Anticipate specific complications based on injury location, battery position and orientation (negative pole). Determine length of observation, duration of esophageal rest, need for serial imaging or endoscopy/bronchoscopy based on severity and location of injury. Monitor patients at risk of perforation into vessels as treatment with serial imaging and stool guaiac. Intervene early to prevent fatality. Monitor for respiratory symptoms, especially those associated with swallowing, to diagnose TE fistulas early. Expect perforations and fistulas to be delayed (68% diagnosed by 48 days after battery removal) and esophageal strictures delayed weeks to months.

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Immediate Treatment of Suspected Button Battery Ingestion

- 10mL of honey (if child > 12 months) or sucralfate every 10min
- Do not induce vomiting or give cathartics

THE
Laryngoscope
FOUNDED IN 1896

Bronchoesophagology

pH-neutralizing esophageal irrigations as a novel mitigation strategy for button battery injury

Rachel R. Anfang MA, Kris R. Jatana MD , Rebecca L. Linn MD, Keith Rhoades BS, Jared Fry BS, Ian N. Jacobs MD

First published: 11 June 2018 | <https://doi.org/10.1002/lary.27312> | Cited by: 4



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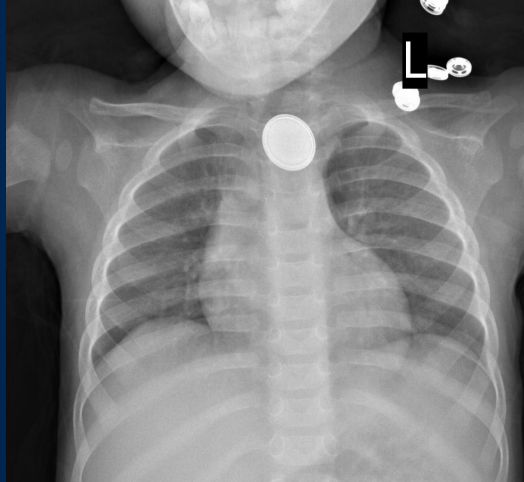
Determining size of battery

- 20 mm lithium coin cell is most frequently involved in esophageal injuries
- Smaller batteries can lodge and cause problems too, but less frequently



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Esophageal Button Battery



Case courtesy of Dr Yair Glick, Radiopaedia.org, rID: 52187



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Esophageal Button Battery

Removed from esophagus 2 hours after ingestion

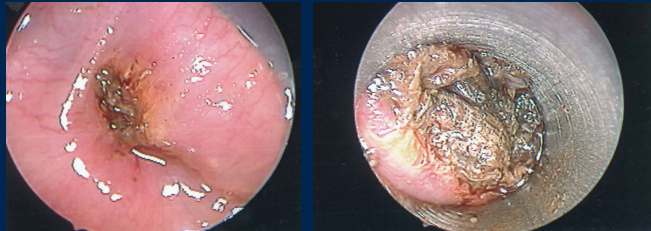


Case courtesy of Dr Yair Glick, Radiopaedia.org, rID: 52187



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Esophagoscopy



Images courtesy of Dr. Anna Messner



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Complications following battery removal

- Esophageal stricture
- Vocal fold paralysis
- Tracheo-esophageal fistula
- Catastrophic hemorrhage



Images courtesy of Dr. Anna Messner



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But wait! There's more!

- 4 year old boy
- Playing with bike light
- Comes to parent "something stuck in nose"

Case courtesy of Dr Alasdair Grenness, Radiopaedia.org, rID: 75978



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Case courtesy of Dr Alasdair Grenness, Radiopaedia.org, rID: 75978



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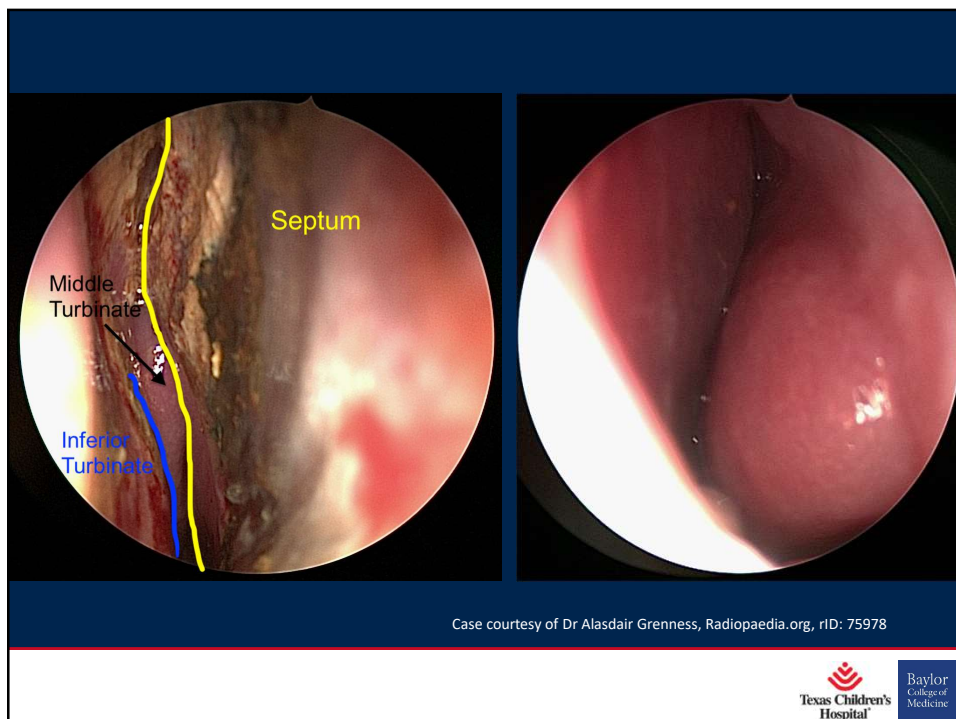
Nasal Button Battery

- EC attempted removal – unsuccessful
- ENT consulted
- To OR within 4-5 hours of insertion

Case courtesy of Dr Alasdair Grenness, Radiopaedia.org, rID: 75978



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Case courtesy of Dr Alasdair Grenness, Radiopaedia.org, rID: 75978









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The Best Offense



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 <p>Remote controls</p>	 <p>Fitness trackers & watches</p>	
<p>Button batteries are in many small electronics you use every day but can cause serious harm or death if swallowed.</p> <p>Buy products with secure battery compartments, and store extra batteries out of sight and reach of children.</p> 		
<p>Tea lights & flameless candles</p> 	<p>Car key fobs & garage door openers</p> 	

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Where can you find button batteries?


- Remote Controls
- Tea lights / flameless candles
- Garage door openers
- Keyless entry fobs
- Bathroom scales
- Parking transponders
- Toys
- Cameras
- Watches
- PDAs
- Calculators
- Digital Thermometers
- Hearing Aids
- Singing Greeting Cards
- Talking books
- Portable stereos
- Handheld Video Games
- Cell phones
- Home medical equipment / meters
- Flash and pen lights
- Flashing shoes
- Toothbrushes
- Bedwetting monitors
- Keychains
- Flashing / lighted jewelry or attire
- Any powered house hold item

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Button Battery Safety

- Store all batteries out of sight and reach of children, preferably in a locked cabinet or container.
- Do not allow children to play with new or used batteries.
- Buy products with a secure battery compartment that requires a tool (often a screwdriver) to open. Check these compartments often to make sure they stay secure over time.
- When replacing batteries, immediately throw away old batteries in a trash can that children cannot access or put batteries for recycling out of sight and reach.
- Check other homes your children visit for possible access to button batteries: grandparents, family members, caregivers, and friends.

 PREVENT CHILD INJURY

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Questions?

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