

National Battery Ingestion Hotline

**Battery Ingestion
Triage and Treatment Guideline**
REVISED SEPT 2016

For additional information contact the
National Battery Ingestion Hotline 24/7 at:

202-625-3333

The National Battery Ingestion Hotline is for both health professionals and the public.
It is staffed by toxicologists and poison information specialists, 24/7.

Guideline from the National Battery Ingestion Hotline at the National Capital Poison Center.

Adapted from Litovitz T, Whitaker N, Clark L, White NC, Marsolek M: Emerging battery ingestion hazard: Clinical implications. Pediatrics 2010;125(6): 1168-1177. epub 24 May 2010.

Also see www.poison.org/battery.

Revised 7 May 2013 to incorporate new information that perforations and fistulas may be delayed up to 28 days after removal of a battery from the esophagus.

Revised 17 Sept 2016 to incorporate new information about esophageal location and irrigation.

©National Capital Poison Center, 2009-2016.

Suspect a battery ingestion in these situations

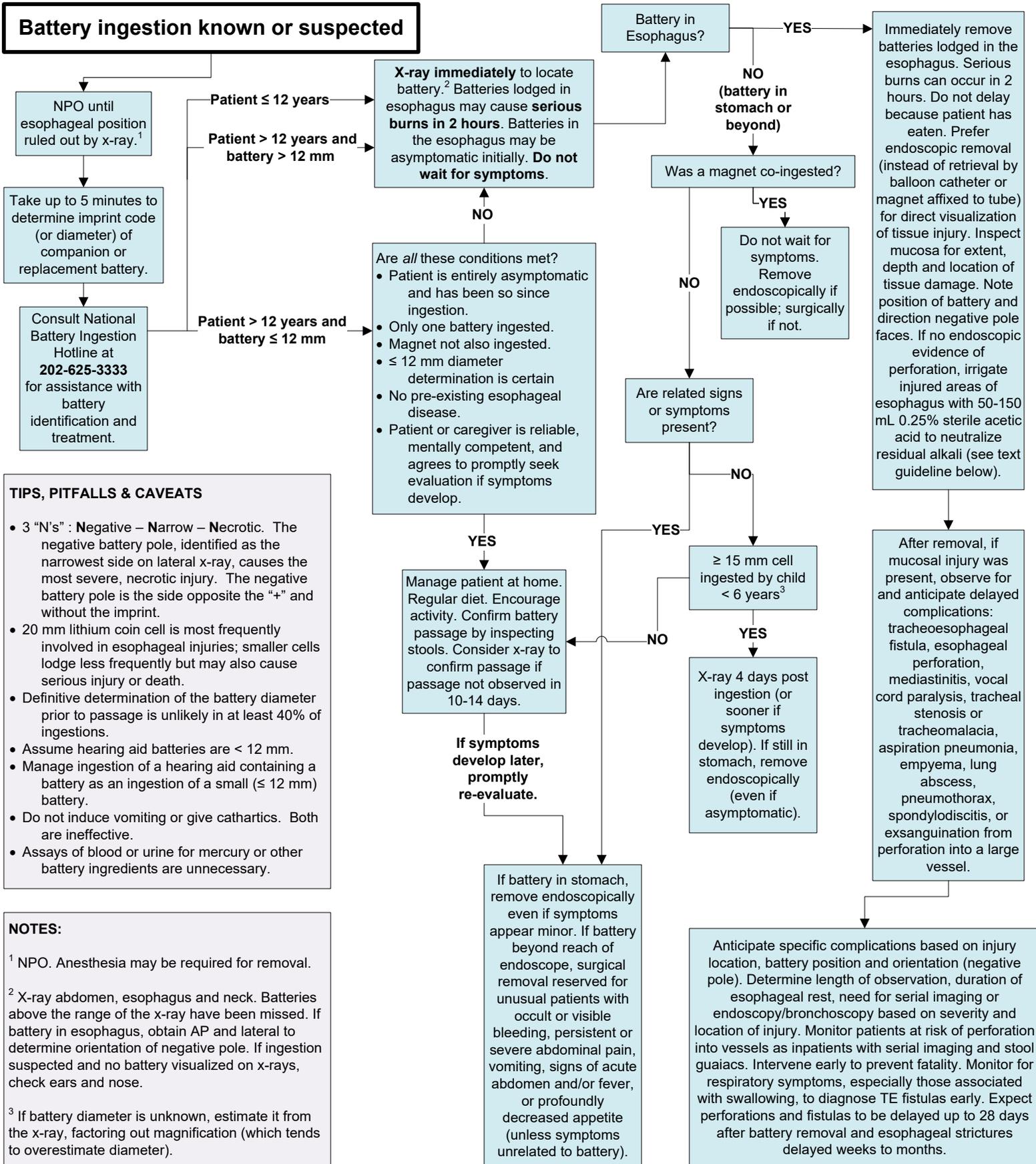
“Coin” ingested.

Check AP x-ray for battery's double-rim or halo-effect and lateral view for step off.

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



TIPS, PITFALLS & CAVEATS

- 3 “N’s” : **N**egative – **N**arrow – **N**ecrotic. 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 may 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:

¹ NPO. Anesthesia may be required for removal.

² 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.

³ If battery diameter is unknown, estimate it from the x-ray, factoring out magnification (which tends to overestimate diameter).

Battery Ingestion Triage and Treatment Guideline (text version)

Suspect the diagnosis:

Most serious battery ingestions are not witnessed. Consider the possibility of a battery ingestion in every patient with acute airway obstruction; wheezing or other noisy breathing; drooling; vomiting; chest pain or discomfort; abdominal pain; difficulty swallowing; decreased appetite or refusal to eat; or coughing, choking or gagging with eating or drinking. Suspect a button battery ingestion in every presumed “coin” or other foreign body ingestion. Carefully observe (zoom in on x-ray imaging) for the button battery’s double-rim or halo-effect on AP radiograph and step-off on the lateral view. Beware that the step-off may not be discernible if the battery is unusually thin or if the lateral film is not precisely perpendicular to the plane of the battery.

If battery ingestion is suspected:

1. Do not induce vomiting. Keep patient NPO until an esophageal battery position is ruled out by x-ray.
 2. If the patient is asymptomatic, take up to 5 minutes to determine the imprint code from a companion or replacement battery, battery packaging, or product instructions. If no imprint code is available, measure or estimate the diameter based on the size of the slot the battery fits in or the size of a comparable battery. To estimate the battery diameter, compare the battery with a U.S. penny (19 mm) and nickel (21 mm).
 3. Consult the National Battery Ingestion Hotline at 202-625-3333 for assistance in battery identification and patient management.
 4. If the patient is ≤ 12 years, *immediately* obtain an x-ray to locate the battery. Batteries lodged in the esophagus may cause serious burns in as little as 2 hours. Do not wait for symptoms to develop. Patients with a battery in the esophagus may be asymptomatic initially. The 20 mm diameter lithium coin cell, with a diameter intermediate between a U.S. penny and nickel, is most frequently involved in esophageal injuries. Smaller cells lodge less frequently, but may also cause serious injury or death, especially in children younger than 1 year.
 5. If the patient is > 12 years and the battery diameter is > 12 mm or unknown, *immediately* obtain an x-ray to locate the battery.
 6. If the patient is > 12 years and the ingested battery is ≤ 12 mm, no x-ray to locate the battery is required if *all* of the following conditions are met:
 - a. The patient is *entirely* asymptomatic and has been asymptomatic since the battery was ingested.
 - b. Only *one* battery was ingested
 - c. A magnet was *not* also ingested.
 - d. The battery has been *reliably* identified based on imprint code or measurement of an identical cell, and the diameter is ≤ 12 mm. Definitive determination of the battery diameter prior to passage is unlikely in at least 40% of ingestions. Assume hearing aid batteries are less than 12 mm.
 - e. There is no history of prior esophageal surgery, esophageal stricture/narrowing, motility disorders, or other esophageal disease.
-

- f. The patient (or caregiver) is reliable, mentally competent, and agrees to report symptoms that develop prior to battery passage, or over the subsequent month if passage is not documented, and understands the importance of promptly seeking evaluation for symptoms possibly related to the ingested battery.
 7. X-rays obtained to locate the battery should include the entire neck, esophagus, and abdomen. Batteries located above the range of the x-ray have been missed, as have batteries assumed to be coins or cardiac monitor electrodes. On physical exam, check both ear canals and the nasal cavity to exclude battery insertion. Obtain both AP and lateral x-rays for batteries in the esophagus to determine orientation of the positive and negative poles. On the lateral film, the step-off is on the negative side of the battery. (The negative pole has a slightly smaller diameter, fitting within the battery can which forms the positive pole.) Anticipate complications based on battery position and orientation. Damage will be more severe in tissue adjacent to the negative pole.
 8. *Immediately* remove batteries lodged in the esophagus. Serious burns can occur in 2 hours. Do not delay removal because a patient has eaten recently. Endoscopic removal is preferred as it allows direct visualization of tissue injury. After removal, inspect the mucosa surrounding the battery to determine the extent, depth, and location of tissue damage. Note the orientation of the battery in the esophagus: is the negative pole (side without the “+” and without the imprint) facing anteriorly or posteriorly? If possible, avoid pushing an esophageal battery into the stomach as the risk of esophageal perforation may increase.
 - a. After a battery is removed from the esophagus, inspect the area endoscopically for evidence of perforation. If none is evident, irrigate the injured areas with 50 mL to 150 mL of 0.25% sterile acetic acid (obtained from the hospital pharmacy). Irrigate in increments and suction away excess fluid and debris through the endoscope. For decades toxicologists have advised against neutralization for fear of causing a thermal injury. However, a recent study (Jatana, 2016) using piglet esophagus preparations after button battery removal, showed only a minimal increase in temperature (0-3 °C), effective tissue surface pH neutralization, and decrease in the visible injury using this neutralization strategy. The tissue surface pH neutralization may reduce the development of progressive, delayed-onset esophageal injury after battery removal.
 9. After removing a battery from the esophagus, if mucosal injury was present, observe for delayed complications such as tracheoesophageal fistula, esophageal perforation, mediastinitis, vocal cord paralysis, tracheal stenosis or tracheomalacia, aspiration pneumonia, empyema, lung abscess, pneumothorax, spondylodiscitis, or exsanguination from perforation into a large vessel.
 - a. Determine the length of observation, duration of esophageal rest, and need for serial imaging or endoscopy/bronchoscopy based on the severity and location of the injury, anticipating specific complications based on the injury location, battery position and orientation. Consider the proximity of the lodged battery and injured area to major arteries. Monitor patients at risk of fistulization into blood vessels carefully, as inpatients, with serial imaging (contrast CT or MRI of chest and/or neck) and stool guaiacs. Intervene early if perforation is imminent. Monitor for respiratory symptoms, especially with swallowing, to diagnose tracheoesophageal fistulas early.
 - b. Expect delayed onset of esophageal perforations and fistulas involving the trachea or major vessels, with delays up to 28 days post removal for esophageal-vascular fistulas and up to 9
-

days post removal for tracheoesophageal fistulas. Recurrent laryngeal nerve injury may be evident on presentation or may not develop or be diagnosed for weeks after battery removal. Esophageal strictures and spondylodiscitis may not manifest for weeks to months post ingestion.

- c. Patients with esophageal injury should be admitted and observed due to the high risk of local edema developing with worsening symptoms, especially airway compromise when the battery is lodged high in the esophagus. In stable, well-appearing children, a clear liquid diet can be started after an esophagram shows no evidence of perforation. The esophagram is obtained at least 1-2 days after battery removal, earlier (1 day) for cases with mucosal injury only, and later for cases with deeper injury. Diet may be advanced to soft as tolerated, but all children who have had an esophageal battery removed should be limited to soft foods for a full 28 days to avoid mechanical damage to a healing esophagus. In children with more severe injuries, subsequent care and diagnostic intervention is guided by clinical manifestations.
 - d. Patients with batteries removed from the upper esophagus should be monitored carefully for voice changes, respiratory distress, or stridor. If any of these are present or suggested, the cords should be visualized under direct laryngoscopic view in the awake patient to confirm bilateral vocal cord mobility. Unilateral or bilateral vocal cord paralysis is a common complication of battery ingestion due to damage to the recurrent laryngeal nerve(s). Paralysis may be delayed and not detected for days or weeks.
 - e. Always consider the possibility of battery proximity to the aorta or other major vessels. If this is anatomically likely due to the position of the battery, use a contrast CT or MRI diagnostically to confirm there is at least 3 mm of tissue between the area of esophageal injury and adjacent vessels. Watch for sentinel bleeds, which may be subtle. Engage cardiothoracic surgery early if there is any possibility of an impending esophageal-vascular fistula.
10. Retrieve batteries, endoscopically if possible, from the stomach or beyond if:
- a. A magnet was also ingested,
 - b. The patient develops signs or symptoms that are likely related to the battery ingestion, or
 - c. A large button battery (≥ 15 mm diameter), ingested by a child younger than 6 years, remains in the stomach for 4 days or longer. If battery diameter is unknown, estimate if from the x-ray, factoring out magnification (which tends to overestimate battery diameter).
 - d. If a large button battery (≥ 20 mm) is in the stomach or beyond of a child younger than 5 years, and based on history, might have lodged in the esophagus for > 2 hours before passing to the stomach, *consider* diagnostic endoscopy to exclude the remote possibility of esophageal injury. (In a handful of cases, patients with significant and symptomatic esophageal injury have been found with batteries that have already passed beyond the esophagus.) If symptoms suggestive of esophageal or gastric injury are (or were) present, urgent endoscopy is recommended to exclude esophageal injury.
11. Allow batteries to pass spontaneously if they have passed beyond the esophagus (stomach and beyond) and no clinical indication of significant gastrointestinal injury is evident. Manage the patient at home on a regular diet. Encourage activity. Avoid unnecessary endoscopic or surgical removal in asymptomatic patients. Promptly re-evaluate all patients who develop signs or symptoms possibly related to the battery. Endoscopic removal of batteries still in the stomach
-

should be pursued for even minor symptoms. For batteries beyond the reach of the endoscope, surgical battery removal may be required in the unusual patients with evidence of occult or visible bleeding, abdominal pain, profoundly decreased appetite, vomiting, signs of an acute abdomen, and/or fever, unless these clinical manifestations are clearly unrelated to the battery. Confirm battery passage by inspecting stools. Consider repeat radiographs to confirm passage if passage not observed in 10-14 days. Confirming passage may avoid urgent diagnostic intervention for minor symptoms developing later.

12. Manage ingestion of a hearing aid containing a battery as an ingestion of a small battery (≤ 12 mm).
13. Avoid these ineffective, unnecessary or unproven therapeutic interventions:
 - a. Ipecac administration (ineffective).
 - b. Blind battery removal with a balloon catheter or a magnet affixed to a nasogastric tube (can't determine extent of injury).
 - c. Blood or urine concentrations of mercury or other battery ingredients (unnecessary).
 - d. Chelation (unnecessary).
 - e. Laxatives (ineffective) or polyethylene glycol electrolyte solution (unproven effectiveness and unknown if solution enhances electrolysis).

Reference:

[Litovitz T, Whitaker N, Clark L, White NC, Marsolek M: Emerging battery ingestion hazard: Clinical implications. *Pediatrics* 2010;125\(6\): 1168-1177. epub 24 May 2010.](#)

Jatana KR, Rhoades K, Milkovich S, Jacobs IN. Basic mechanism of button battery ingestion injuries and novel mitigation strategies after diagnosis and removal. *Laryngoscope* 2016; in press.

Revised: 9/2016
