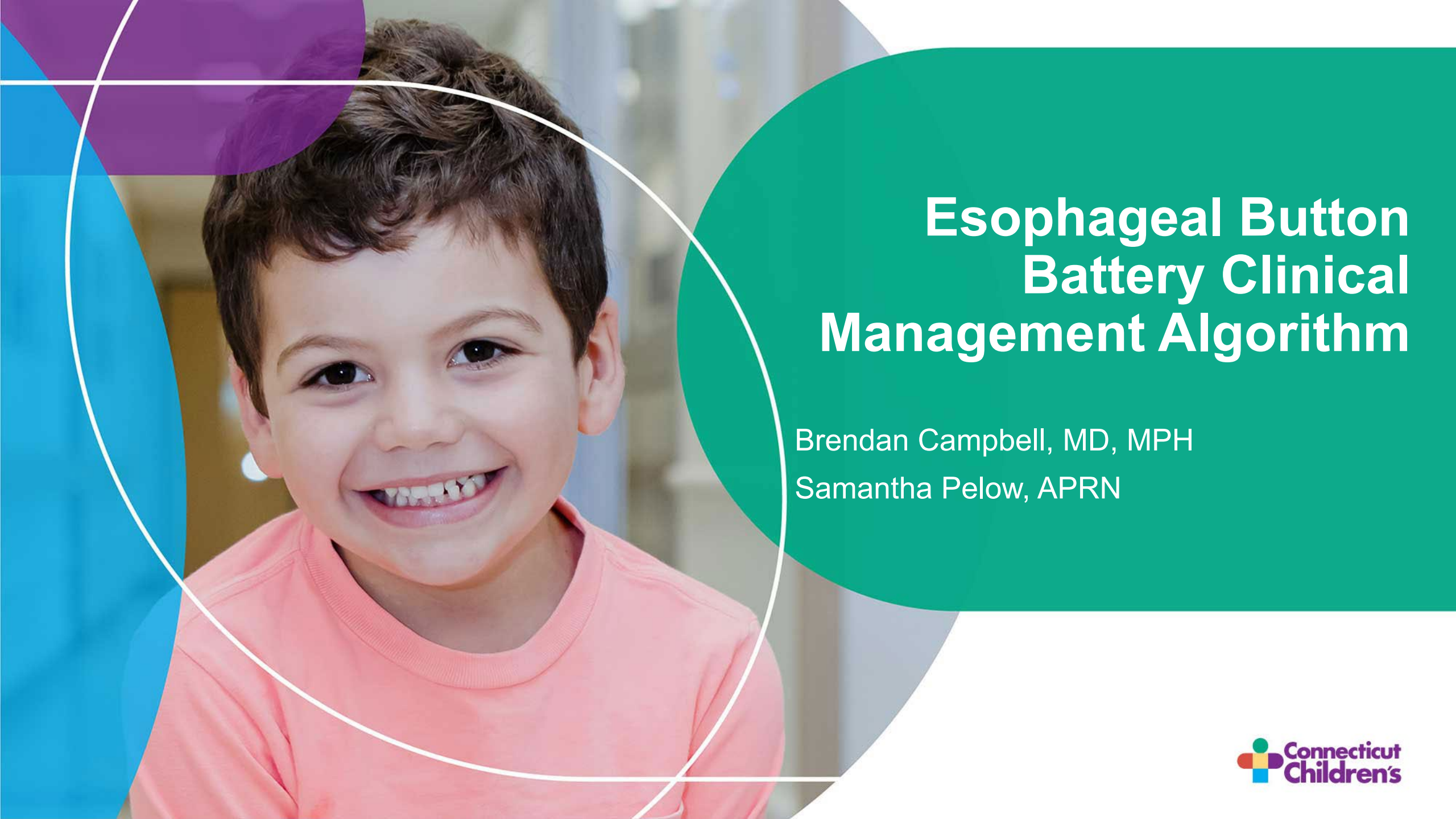




Esophageal Button Battery Clinical Management Algorithm

Brendan Campbell, MD, MPH

Samantha Pelow, APRN

What is a Clinical Management Algorithm?

An evidence-based guideline that decreases unnecessary variation, ensures appropriate and timely allocation of resources, and helps promote safe, effective, and consistent patient care.

Objectives of Clinical Management Algorithm

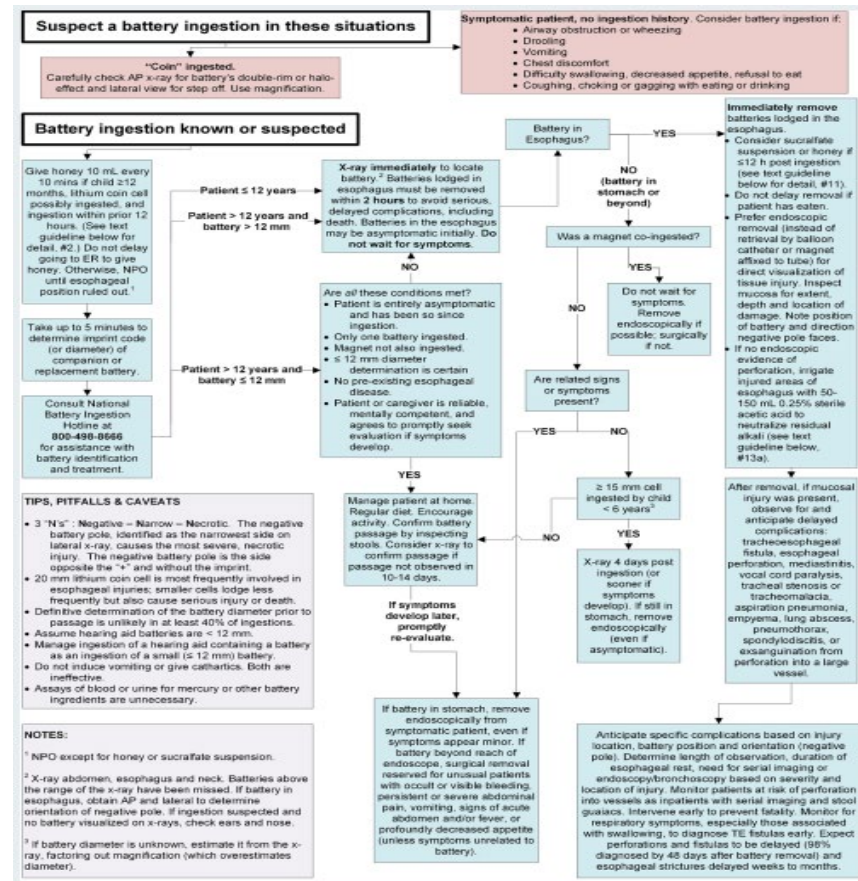
- Standardize care to decrease variation in the management of patients with ingestion of esophageal button batteries
- Decrease time to operative removal in order to improve clinical outcomes for patients with button battery ingestions
- Decrease unnecessary interventions and testing
- Clearly delineate safe discharge criteria

Why is this algorithm necessary?

- In the US, approximately 3,500 children are treated annually in emergency departments for button battery ingestions
- Button batteries that are lodged in the esophagus have been found to cause catastrophic thermal injuries
 - The quicker they are recognized and removed, the less severe the injury is likely to be
 - Damage is primarily caused from external currents that causes electrolysis of tissue fluids, generating hydroxide
- Progression can lead to death within 6 hours of ingestion in some cases; batteries should be removed within 2 hours of ingestion
- Increased awareness and standardization of management can lead to more prompt removal of the battery and improved outcomes

Background

- The National Capital Poison Center has a clinical management algorithm available for button battery ingestions

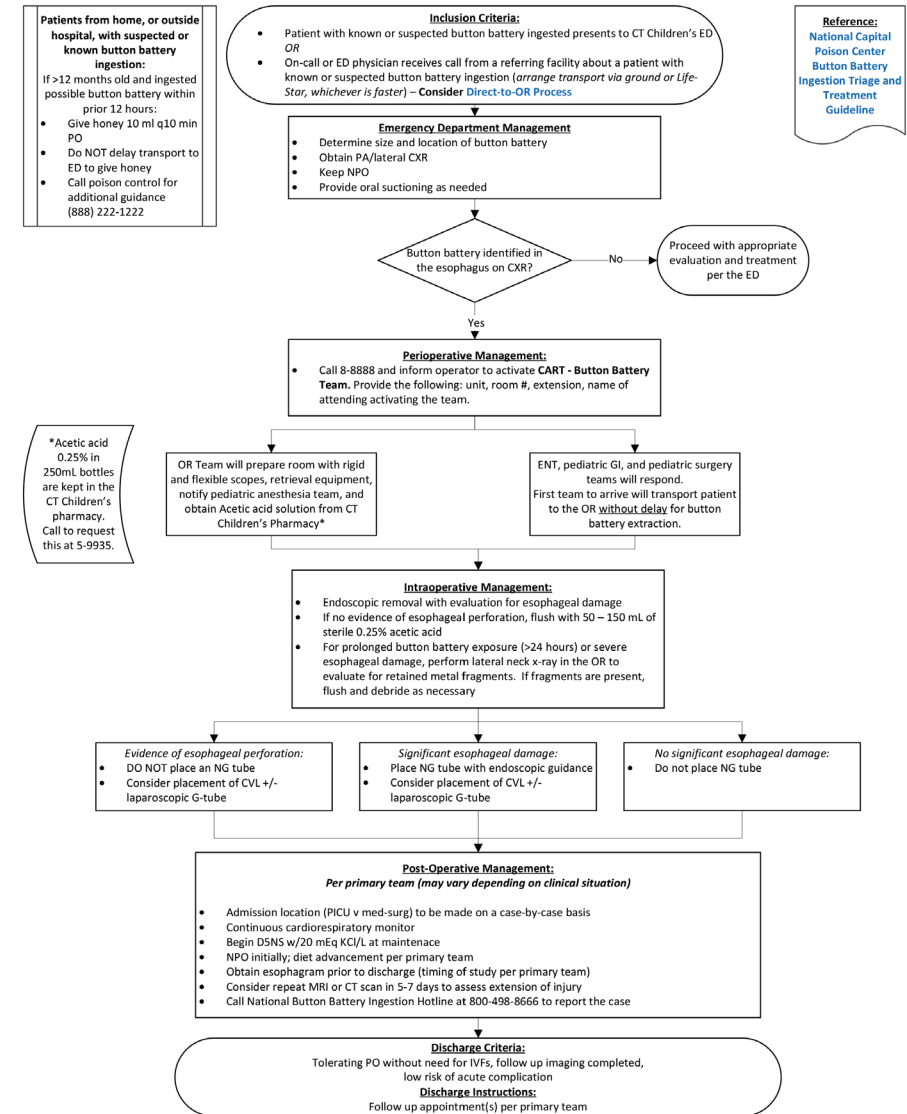


This is the Esophageal Button Battery Clinical Management Algorithm.

We will be reviewing each component in the following slides.

CLINICAL PATHWAY: Esophageal Button Battery Clinical Management Algorithm

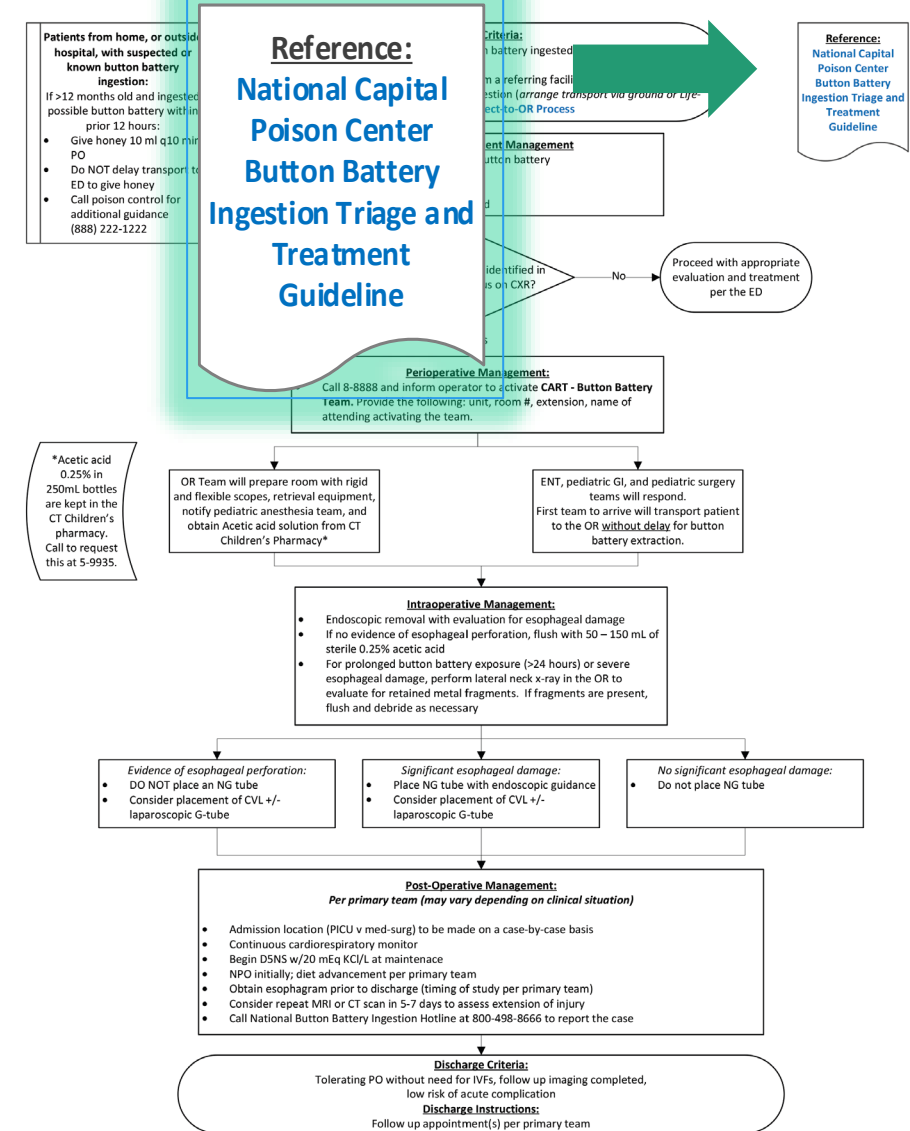
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- There is a direct link from the algorithm to the National Capital Poison Center's Treatment Guideline as a reference.
- Click on the blue text to access it and is also available here:
www.poisson.org/battery/guideline

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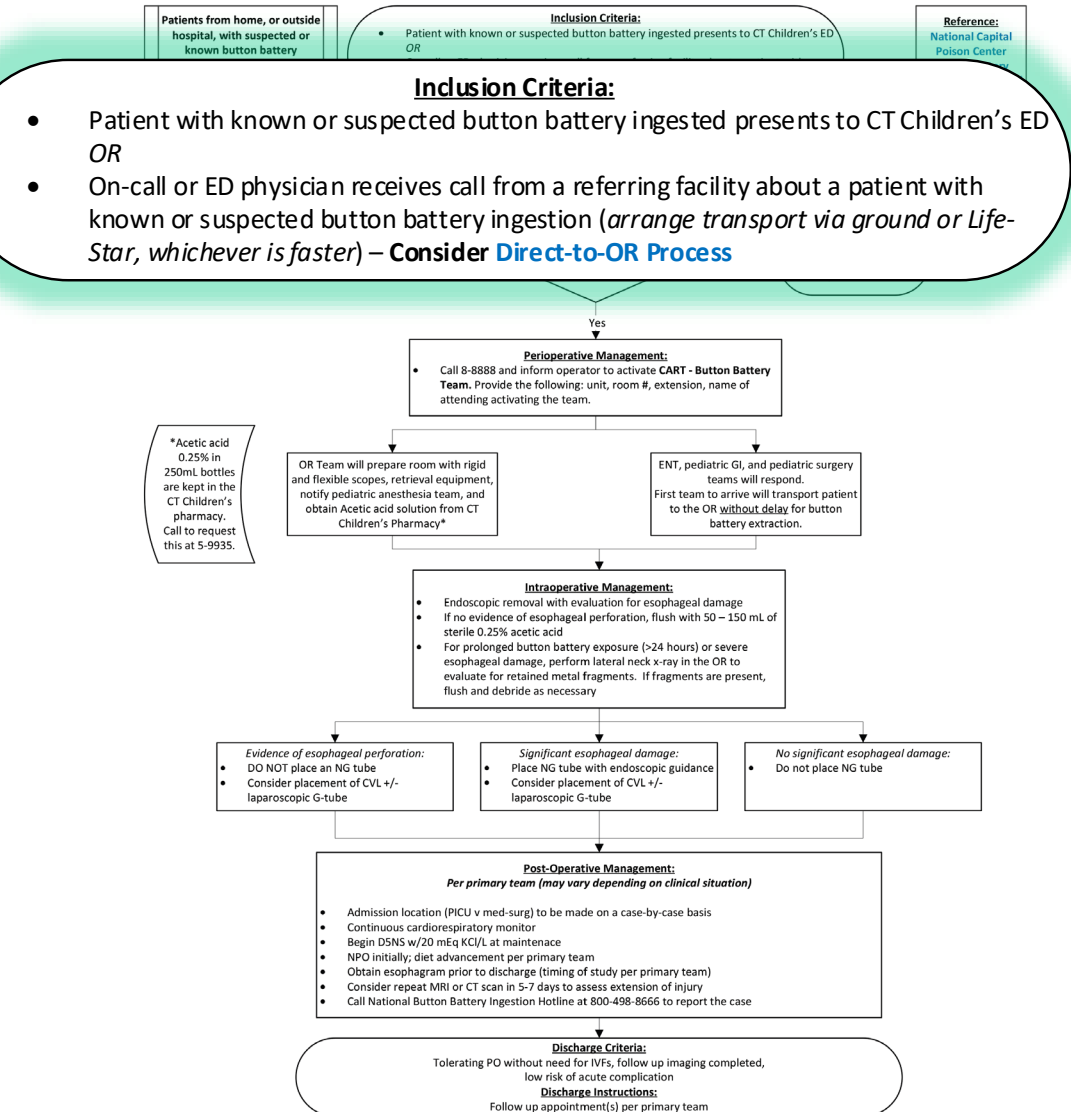
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- Any child with a known or suspected button battery ingestion should follow this algorithm.
- According to the National Capital Poison Center, most serious button battery ingestions are not witnessed.
- Suspect that a button battery ingestion occurred for every “coin” or other foreign body is ingested.



CLINICAL PATHWAY: Esophageal Button Battery Clinical Management Algorithm

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DIRECT TO OR PROCESS

Pre-hospital notification or transfer referral for a patient with an injury that likely requires immediate surgical intervention

ED Attending contacts Attending Surgeon from appropriate service
Or
OneCall Connects referring hospital physician with appropriate Attending Surgeon

No
Yes
*Would the patient potentially benefit from transfer directly to the operating room?

Patient transported to the Emergency Department



OneCall

*Cases that might benefit from Direct to OR transfer:

- Arterial Bleeding from Penetrating Injury
- Esophageal Button Battery
- Testicular Torsion w/referring hospital U/S
- Surgical Intervention at referring hospital
- Known Intracranial Bleed (referring hospital CT)
- Hypotension in the field

- Attending Surgeon contacts OR team at 860-545-9329
- OneCall initiates registration, transfer of referring hospital imaging
- OR team opens encounter
- Surgical Team books case (or OR nurse)

OR Charge Nurse identifies appropriate room

Patient transported directly from ambulance bay or tunnel elevator to the Operating Room

- Place ID band on patient
- Primary survey/initial evaluation performed
- Decision re: emergent surgery vs CT
- Case begins*
- Primary team completes a comprehensive evaluation of patient when medically appropriate



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Patients from home, or outside hospital, with suspected or known button battery

Inclusion Criteria:
• Patient with known or suspected button battery ingested presents to CT Children's ED OR

Reference:
National Capital Poison Center

Inclusion Criteria:

- Patient with known or suspected button battery ingested presents to CT Children's ED OR
- On-call or ED physician receives call from a referring facility about a patient with known or suspected button battery ingestion (*arrange transport via ground or Life-Star, whichever is faster*) – Consider **Direct-to-OR Process**

Yes

Perioperative Management:

- Call 8-8888 and inform operator to activate **CART - Button Battery Team**. Provide the following: unit, room #, extension, name of attending activating the team.

*Acetic acid 0.25% in 250mL bottles are kept in the OR

OR Team will prepare room with rigid and flexible scopes, retrieval equipment, and fluoroscopy.

ENT, pediatric GI, and pediatric surgery teams will respond. First team to arrive will transport patient.

There is a new "Direct-to-OR Process" for patients with esophageal button battery confirmed at outside facilities.

Evidence of esophageal perforation:

- DO NOT place an NG tube
- Consider placement of CVL +/- laparoscopic G-tube

Significant esophageal damage:

- Place NG tube with endoscopic guidance
- Consider placement of CVL +/- laparoscopic G-tube

No significant esophageal damage:

- Do not place NG tube

Post-Operative Management:

Per primary team (may vary depending on clinical situation)

- Admission location (PICU v med-surg) to be made on a case-by-case basis
- Continuous cardiorespiratory monitor
- Begin D5NS w/20 mEq KCl/L at maintenance
- NPO initially; diet advancement per primary team
- Obtain esophagram prior to discharge (timing of study per primary team)
- Consider repeat MRI or CT scan in 5-7 days to assess extension of injury
- Call National Button Battery Ingestion Hotline at 800-498-8666 to report the case

Discharge Criteria:

Tolerating PO without need for IVFs, follow up imaging completed, low risk of acute complication

Discharge Instructions:

Follow up appointment(s) per primary team

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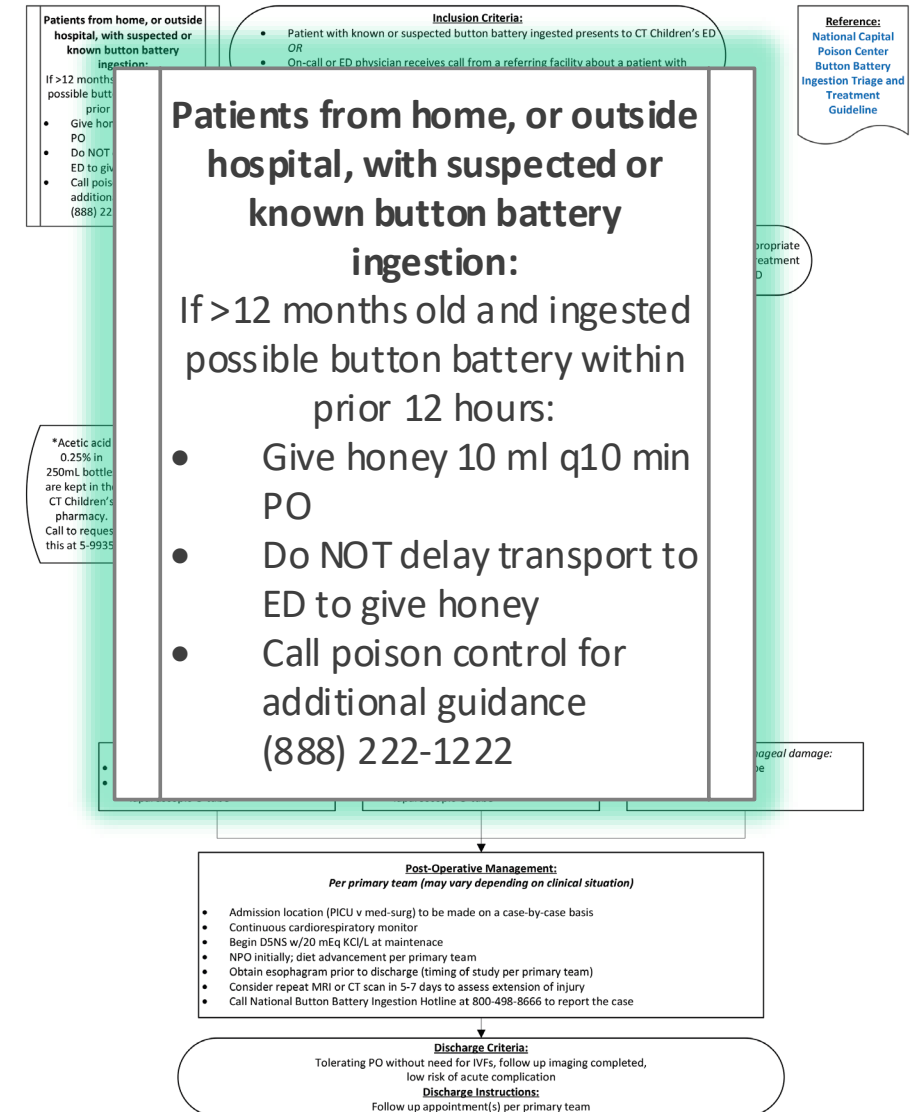


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- Honey should be given if the patient is over 12 months old, there was a possible button battery ingestion in the prior 12 hours, and the child is able to swallow.
- Honey has been shown to coat the button battery to prevent hydroxide formation and will delay alkaline burns.
- Giving honey should not replace, or delay, removal of the button battery. DO NOT delay transport to the emergency department to give honey. The button battery must still be removed in a timely fashion.

CLINICAL PATHWAY: Esophageal Button Battery Clinical Management Algorithm

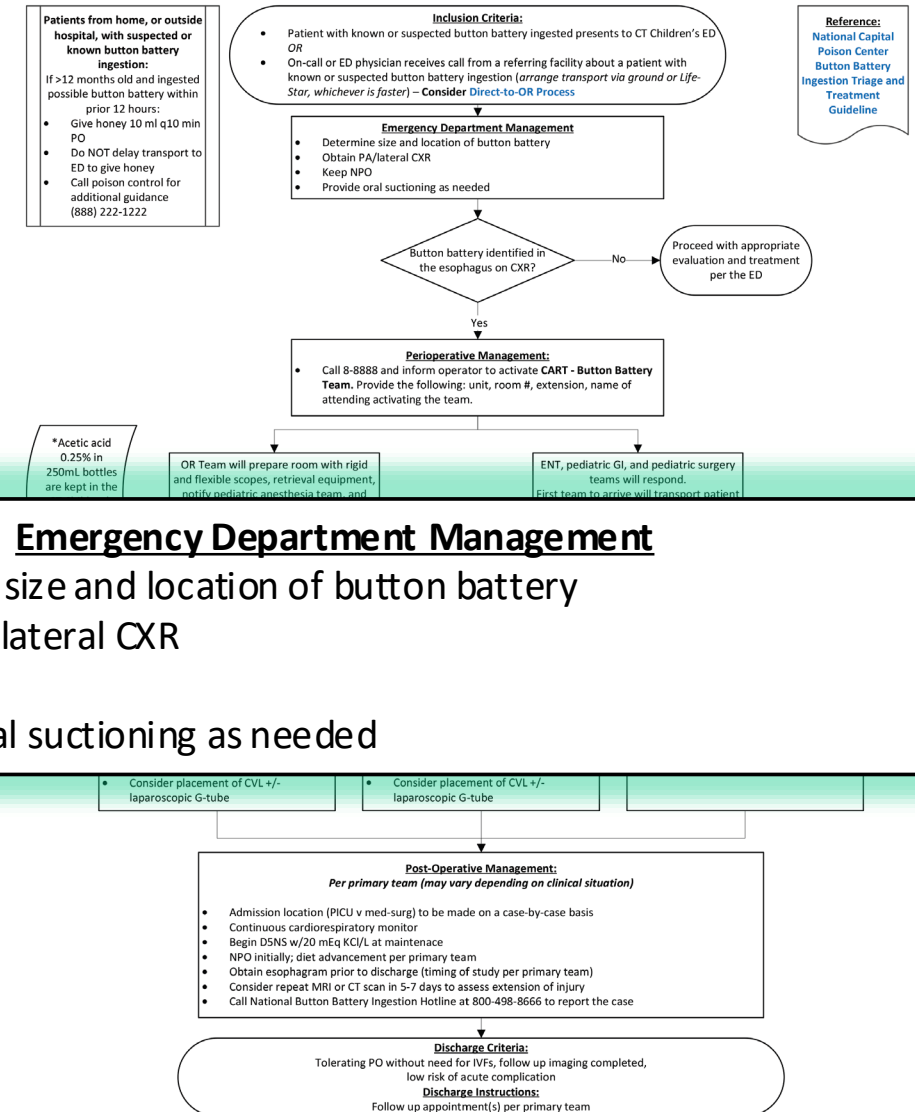
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Besides honey, keeping the patient NPO is important until button battery size and location is determined by XR.



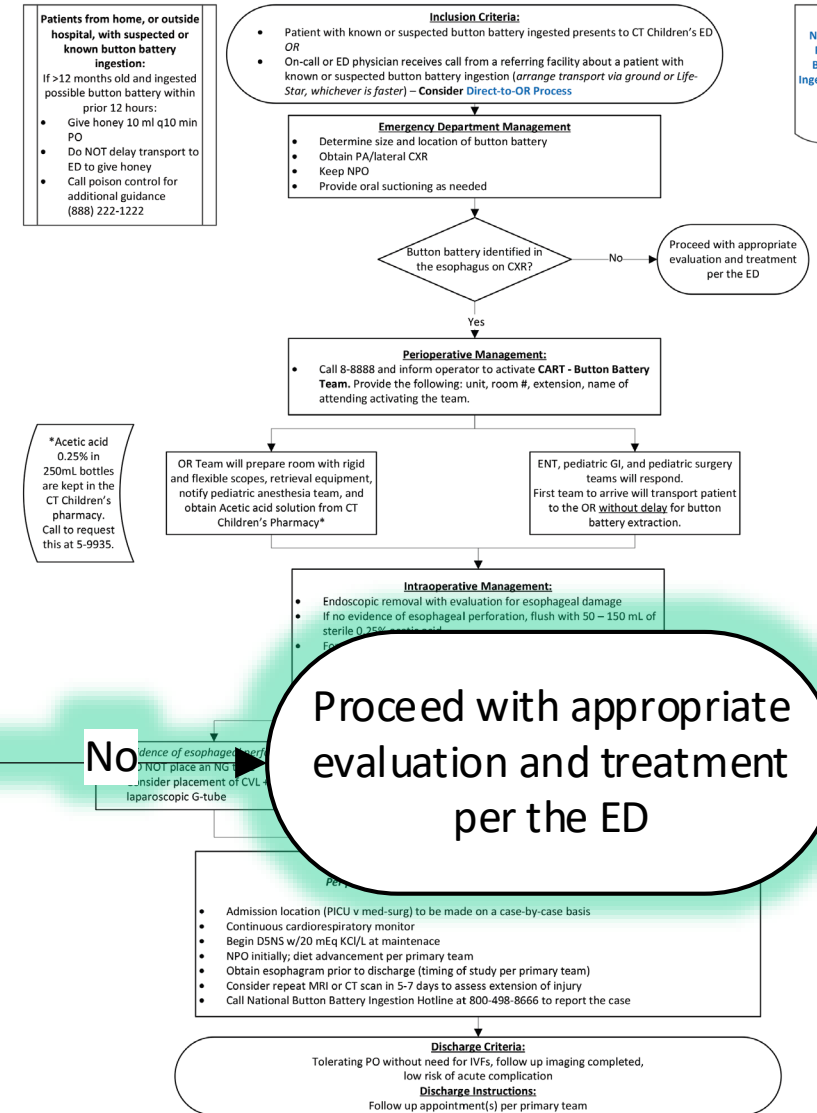
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Reference:
National Capital
Poison Center
Ingestion Triage and
Treatment
Guideline



If there is no button battery identified in the esophagus, then care should proceed off of the algorithm, per the ED.

Button battery identified in the esophagus on CXR?

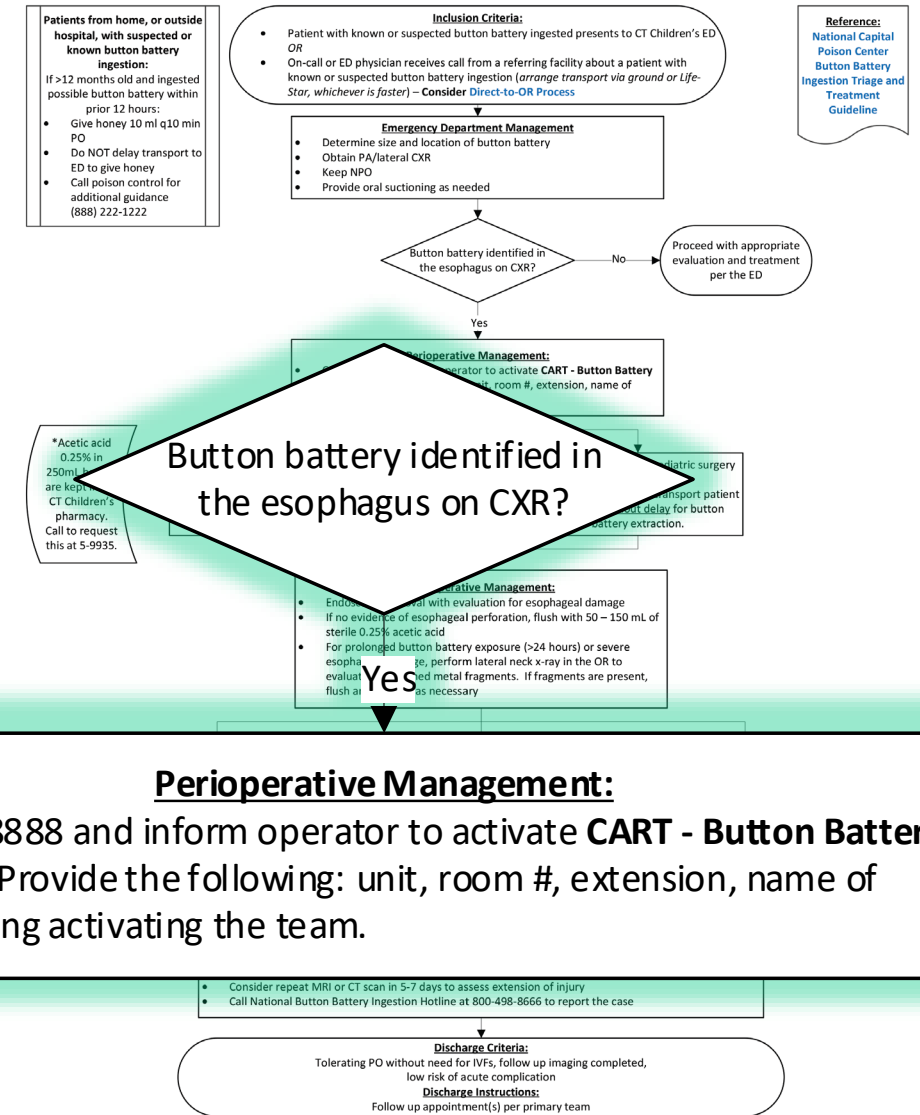
No

Proceed with appropriate evaluation and treatment per the ED

CLINICAL PATHWAY: Esophageal Button Battery Clinical Management Algorithm

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- If the button battery is unfortunately found in the esophagus, timely operative management is essential. This is done via activation of the CART - Button Battery Team.
- The CART – Button Battery Team is a specialized team comprised of pediatric ENT, GI and surgery.



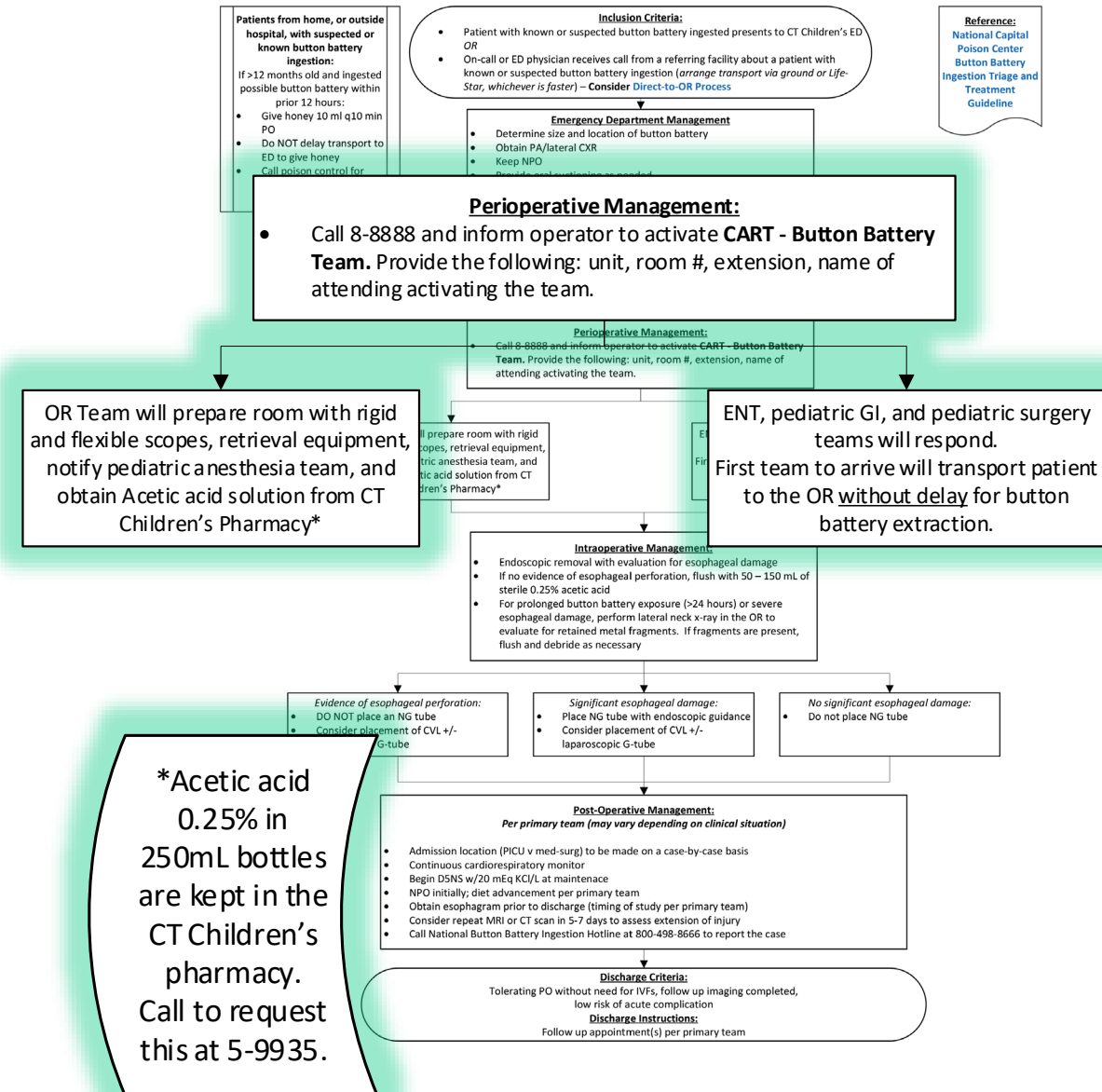
- Perioperative Management:**
- Call 8-8888 and inform operator to activate **CART - Button Battery Team**. Provide the following: unit, room #, extension, name of attending activating the team.

CLINICAL PATHWAY: Esophageal Button Battery Clinical Management Algorithm

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Once CART – Button Battery Team is activated, two major processes will occur:

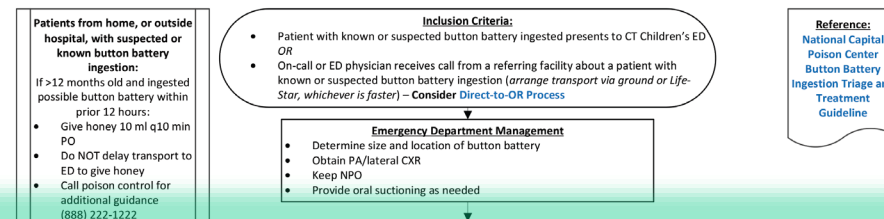
- ENT, GI and surgery teams will respond.
 - Whoever is the first to respond to the patient will need to transport the patient to the OR without delay for the button battery extraction.
- The OR will begin prepping the room and notify the pediatric anesthesia team, as well as obtaining acetic acid from the pharmacy in preparation for intraoperative management.



- Endoscopic removal is the preferred method as it also allows evaluation of any esophageal damage.
- If there is no evidence of esophageal perforation, flushing with 0.25% acetic acid can reduce the development of delayed-onset esophageal injury after battery removal.
- If the button battery exposure was prolonged, or severe damage has occurred, evaluation of retained metal fragments.

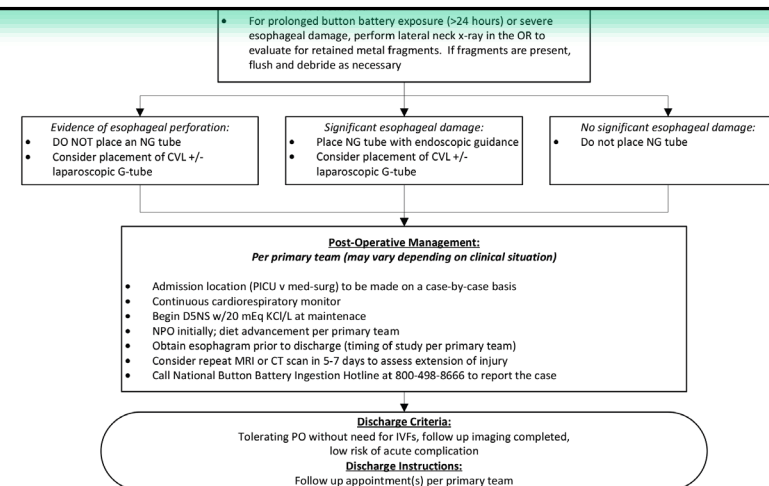
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Intraoperative Management:

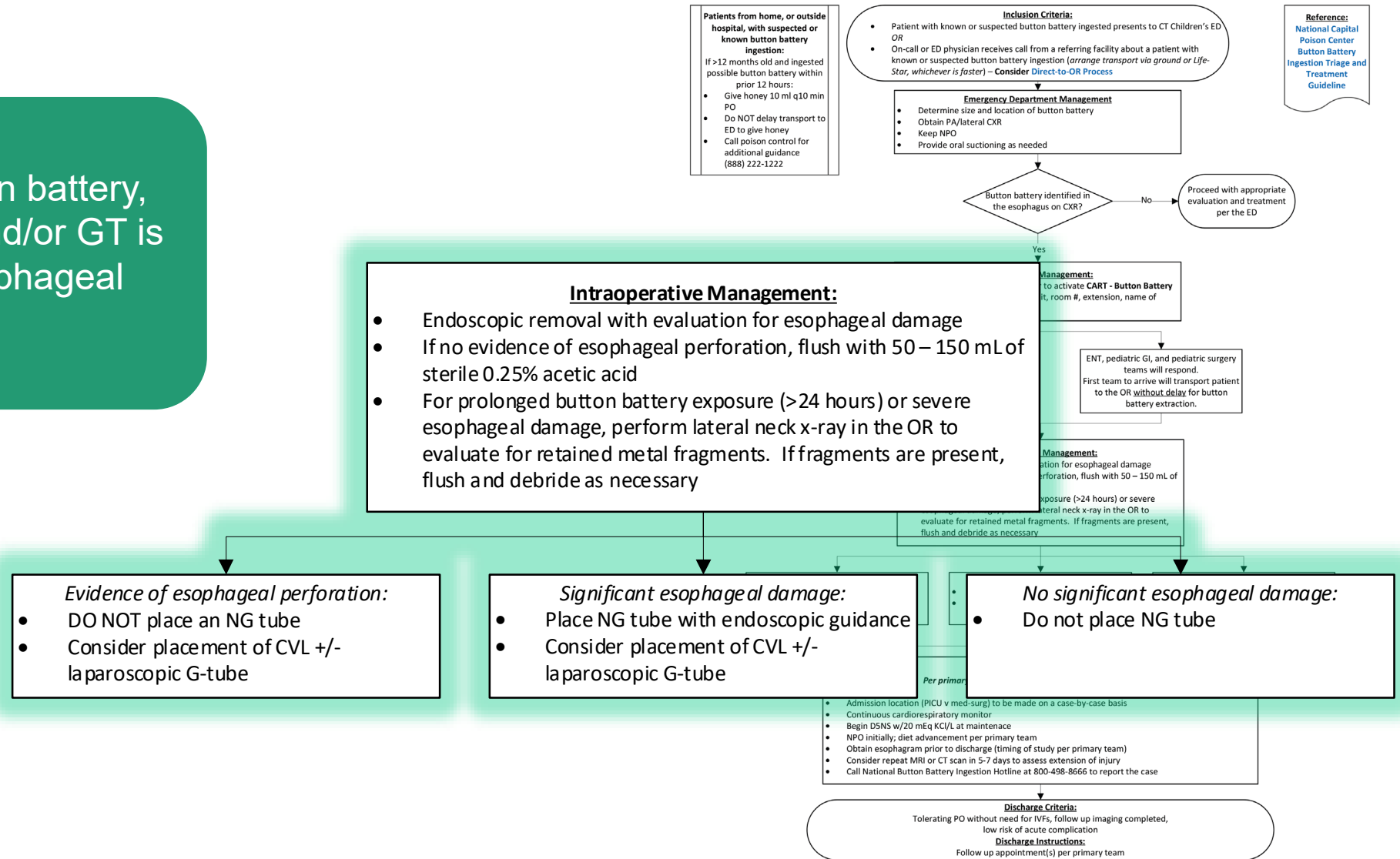
- Endoscopic removal with evaluation for esophageal damage
- If no evidence of esophageal perforation, flush with 50 – 150 mL of sterile 0.25% acetic acid
- For prolonged button battery exposure (>24 hours) or severe esophageal damage, perform lateral neck x-ray in the OR to evaluate for retained metal fragments. If fragments are present, flush and debride as necessary



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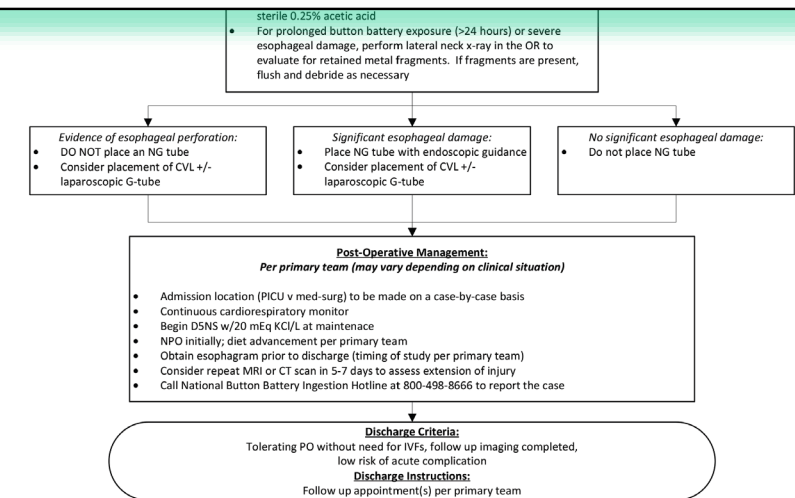
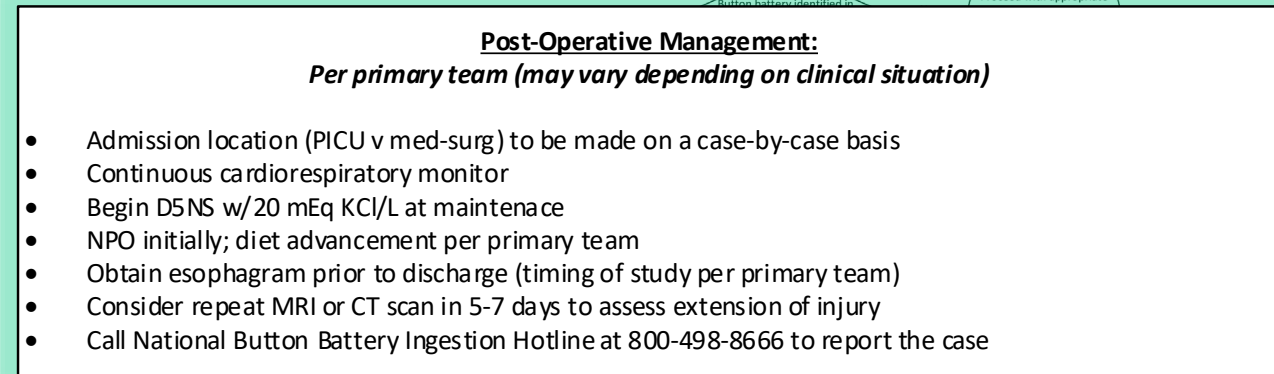
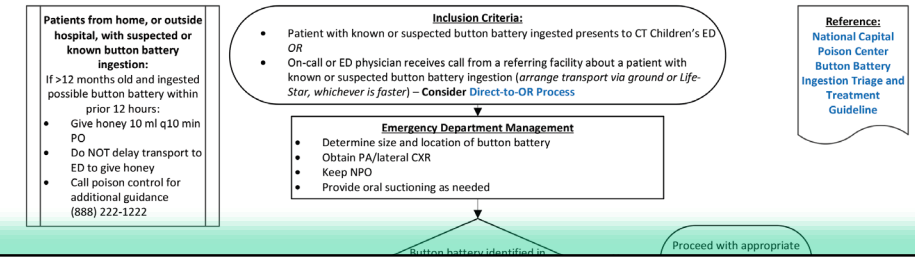
After removal of the button battery,
placement of NGT, CVL and/or GT is
based on degree of esophageal
damage present.



- Post-operative management may slightly vary depending on the clinical situation.
- The primary team will obtain an esophagram and may consider a repeat MRI or CT to assess extension of injury.
- Per the National Capital Poison Center, some delayed complications could include:
 - Tracheoesophageal fistula
 - Esophageal perforation
 - Vocal cord paralysis
 - Tracheal stenosis or tracheomalacia
 - Aspiration PNA
 - Exsanguination from perforation into a large vessel

CLINICAL PATHWAY: Esophageal Button Battery Clinical Management Algorithm

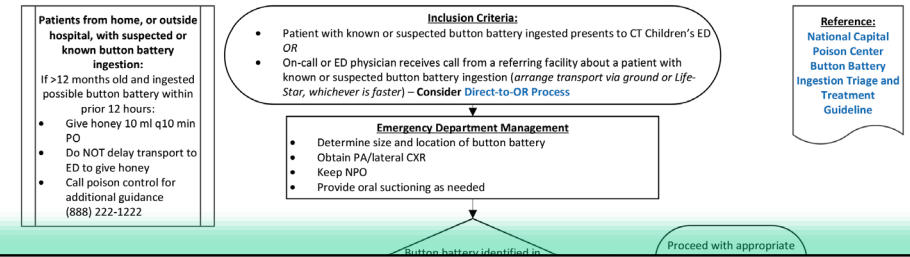
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- All cases should be reported to the National Button Battery Ingestion Hotline at 800-498-8666.

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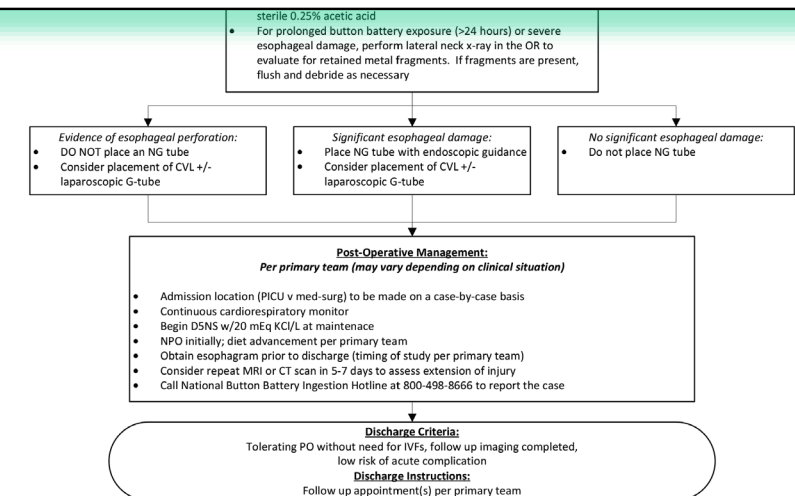
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Post-Operative Management:

Per primary team (may vary depending on clinical situation)

- Admission location (PICU v med-surg) to be made on a case-by-case basis
- Continuous cardiorespiratory monitor
- Begin D5NS w/20 mEq KCl/L at maintenance
- NPO initially; diet advancement per primary team
- Obtain esophagram prior to discharge (timing of study per primary team)
- Consider repeat MRI or CT scan in 5-7 days to assess extension of injury
- Call National Button Battery Ingestion Hotline at 800-498-8666 to report the case



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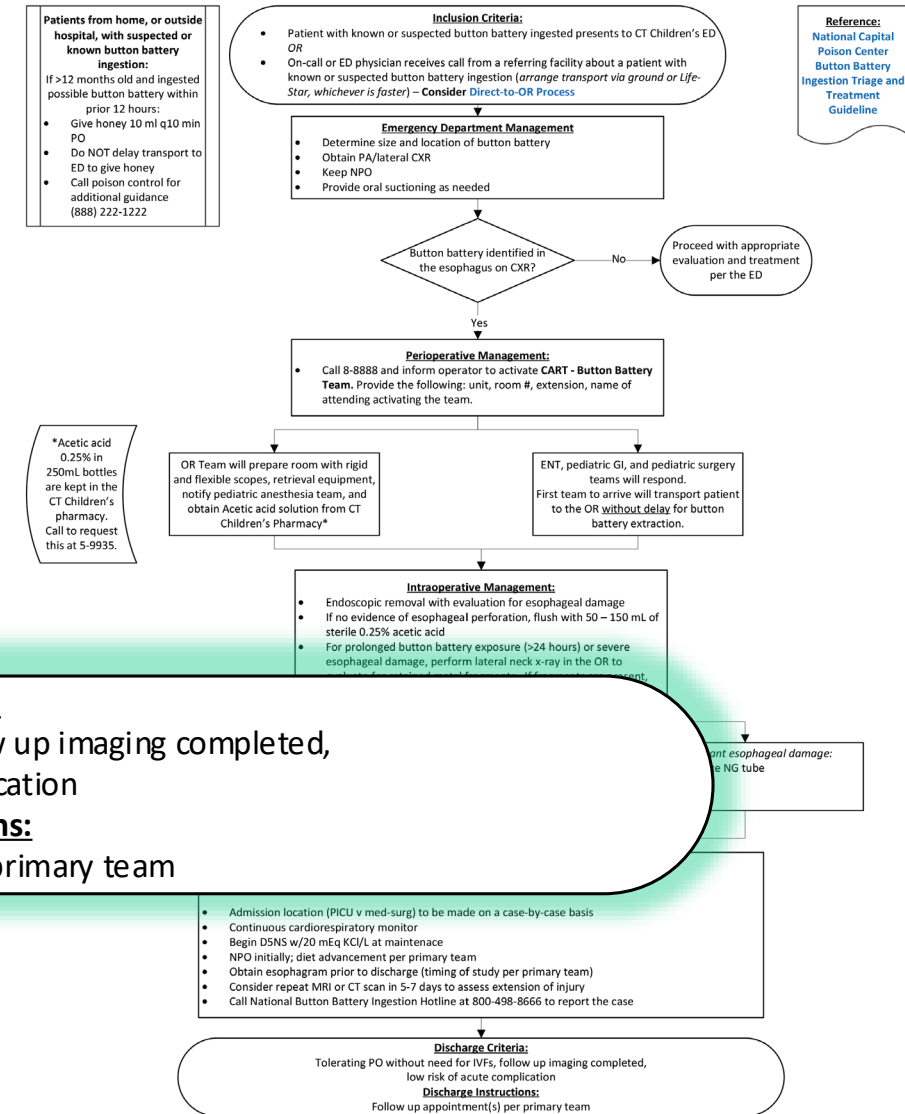
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Discharge criteria would include ability to tolerate PO without IVF with low risk of acute complications, and repeat imaging completed prior to discharge.



Discharge Criteria:
Tolerating PO without need for IVFs, follow up imaging completed,
low risk of acute complication

Discharge Instructions:
Follow up appointment(s) per primary team

Review of Key Points

- Esophageal button batteries can have catastrophic outcomes if unrecognized and there is a delay in removal
 - Prompt recognition and transport to the OR for removal is imperative in improving clinical outcomes
- The algorithm was developed to assist providers in management and help expedite time to removal
- Intra-operative placement of central venous access and decisions regarding resumption of enteral feeding should be discussed case-by-case and based on level of esophageal injury
- Post-operative management is variable and adjusted on a case-by-case basis
 - Children should have an esophagram prior to discharge
- All cases should be directly reported to the National Button Battery Hotline

- Process Measures
 - Time from presentation to diagnosis
 - Time from diagnosis to removal of battery
- Outcome Measures
 - Admit length of stay
 - Number of patients with admission to the PICU

Pathway Contacts

- Brendan Campbell, MD, MPH
- Katerina Dukleska, MD
- Evan Fusaro, PA
- Elizabeth Peling, RN
- Jennifer Tabak, RN, MSN

(all Pediatric Surgery, CT Children's)

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Thank You!



About Connecticut Children's Clinical Pathways Program

The Clinical Pathways Program at Connecticut Children's aims to improve the quality of care our patients receive, across both ambulatory and acute care settings. We have implemented a standardized process for clinical pathway development and maintenance to ensure meaningful improvements to patient care as well as systematic continual improvement. Development of a clinical pathway includes a multidisciplinary team, which may include doctors, advanced practitioners, nurses, pharmacists, other specialists, and even patients/families. Each clinical pathway has a flow algorithm, an educational module for end-user education, associated order set(s) in the electronic medical record, and quality metrics that are evaluated regularly to measure the pathway's effectiveness. Additionally, clinical pathways are reviewed annually and updated to ensure alignment with the most up to date evidence. These pathways serve as a guide for providers and do not replace clinical judgment.