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Left Common Carotid Artery Pseudoaneurysm After Unwitnessed Lithium Button Battery Ingestion in a Toddler: Successful Endovascular Hemostasis Following Life-Threatening Bleeding

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ABSTRACT

The landscape of pediatric injury has shifted dramatically alongside the strategic evolution of household electronics. As consumer technology pursues extreme miniaturization, manufacturers have increasingly transitioned to high-energy-density lithium-ion chemistries. The strategic challenge for the clinician is that a battery small enough to be swallowed by infants and toddlers is often large enough to bridge the esophageal lumen, initiating catastrophic tissue destruction within minutes. Commonly, mucosal injury begins within 15 minutes, and full-thickness burns can occur within 4 hours, with severe complications, such as vocal cord paralysis, spondylodiscitis, aorto-esophageal stricture/stenosis, tracheoesophageal fistula (TEF), or aorto-esophageal fistula (AEF). In the article, we present a successful multidisciplinary management of an extremely rare clinical case: a 2-year-old female patient with trisomy 21 who experienced severe bleeding from a left carotid pseudoaneurysm following ingestion of a CR2032 3V Lithium button battery, treated with endovascular repair. This case highlights that (i) severe injury may evolve despite early removal, (ii) bleeding after button battery ingestion warrants urgent vascular evaluation, and (iii) carotid-esophageal fistula, though rare, should be considered in recurrent bright-red hematemesis following esophageal button battery injury.

Keywords: Button battery ingestion; esophageal injury; carotid-esophageal fistula; pseudoaneurysm; mediastinitis; endovascular therapy; pediatric hemorrhage.

INTRODUCTION

Battery ingestion is a time-critical pediatric emergency, particularly when a button battery becomes lodged in the esophagus. Although many ingested batteries pass uneventfully through the gastrointestinal tract, esophageal impaction can cause severe caustic injury within hours and may lead to perforation, fistulization, hemorrhage, and death. A practical clinical framework should therefore distinguish between button batteries (coin/disk cells) and cylindrical batteries (e.g., AA/AAA types), because their injury profiles and management pathways differ.[1-3]

As defined by current clinical surveillance, button batteries (also known as coin or disk batteries) are characterized by: [4]

- Dimensions: Typically, 5-25 mm in diameter and 1-6 mm in height. The 20 mm diameter lithium cell is the most significant driver of severe morbidity due to its propensity for esophageal impaction.
- Chemistry: Formulations include lithium, silver, zinc, and heavy metals such as nickel, cadmium, and mercury.
- Caustic Electrolytes: High concentrations of potassium hydroxide or sodium hydroxide.

Epidemiology and demographics

Across contemporary datasets, young children—especially those under 6 years of age—are the highest-risk group. In the Canadian poison-center analysis, 62% of Canadian Surveillance System for Poison Information (CSSPI) system cases and 69% of British Columbia Drug and Poison Information Centre (DPIC) cases occurred in children under 6 years; in the Dutch national pediatric surveillance study, the median age was 2.8 years, and the population-related incidence was 1.18 per 100,000 children per year. In the Lisbon tertiary-center pediatric series, the median age was 26 months, reinforcing the observation that the most serious cases cluster in toddlers.[2,3,5]

Male predominance is slight and inconsistent across datasets, so it is more accurate to state that the sex distribution is roughly balanced, with a small male excess in some cohorts, rather than overinterpreting it. In addition, the Canadian surveillance paper identified a meaningful secondary risk group among adults older than 59 years, often involving hearing-aid batteries mistaken for pills. The same paper also showed that poison-center data are useful for surveillance but likely underestimate true clinical burden and long-term complications, so those rates should not be presented as definitive population incidence without qualification.[3]

A cautious summary of exposure source is that most pediatric ingestions occur in household settings, commonly involving batteries from consumer products such as hearing aids, toys, watches, flashlights, and other small electronic devices.[3,6]

Pathophysiology and mechanisms of Injury

The dominant mechanism of severe esophageal injury is electrolyte-mediated tissue injury, not simple leakage alone. When a button battery contacts esophageal mucosa, the tissue completes an electrical circuit, generating hydroxide ions at the negative pole and rapidly creating a highly alkaline

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environment that causes liquefactive necrosis. Pressure necrosis and leakage of alkaline contents may contribute, but electrolysis is considered the principal driver of injury. It is a dangerous misconception that "spent" or "dead" batteries are safe. Even batteries that no longer power a device retain sufficient residual voltage to drive the 2nd-order hydrolysis reactions required for full-thickness burns.[1,7]

Mucosal injury may begin within 15 minutes, and severe injury can develop within 2 hours; therefore, esophageal impaction is treated as an emergency. The most severe injuries are associated with larger (especially ≥20 mm) 3-V lithium button batteries, particularly in small children, because these cells are both more likely to lodge and to generate rapid alkaline injury. Crucially, while destruction is rapid, the clinical diagnosis of perforation is often delayed; evidence suggests perforation is rarely diagnosed within the first 12 hours, creating a period of deceptive clinical stability that must not lead to complacency.[1,2,6]

By contrast, ingestion of cylindrical batteries is usually low risk and often amenable to conservative management, but it is not benign in all cases. In the 2025 pediatric cylindrical battery series, conservative management was appropriate for most children. However, the authors specifically advised timely removal when the battery is A23 or A27 type, damaged, retained, or associated with symptoms, multiple ingestion, or prior abdominal surgery.[8]

Clinical presentation: witnessed vs unwitnessed ingestion

Clinical presentation is often nonspecific, and unwitnessed ingestion is especially dangerous because diagnosis is delayed until complications develop. Acute presentations of witnessed ingestion are more likely to include vomiting, drooling, dysphagia, irritability, coughing, stridor, and respiratory distress. In contrast, delayed presentations may include fever, refusal to feed, hematemesis, melena, neck pain/stiffness, cough, hoarseness, or sudden hemorrhage.[1,2]

One useful data point from the Lisbon tertiary-center series is that symptoms were present in 100% of esophageal battery cases but only 24% of gastric battery cases. This is a good teaching point, but it should be identified as a single-center observational finding rather than a universal rule.[2]

A key red flag is mid-esophageal impaction, which carries the greatest concern for aortoesophageal fistula (AEF) because of proximity to the aorta. Hematemesis or melena in this setting should be treated as a warning sign of advanced injury and possible vascular involvement.[1]

Diagnostic imaging

Any suspected battery ingestion requires urgent radiographic evaluation, ideally with two views (Ateroposterior and lateral), including the entire neck, chest, and abdomen. On AP view, clinicians should look for the double-ring / halo sign, representing the battery's two-layer construction; on lateral view, they should assess for the step-off sign, which helps distinguish a button battery from a coin and identifies the negative pole orientation.[1,9]

Advanced imaging is indicated when there is concern for complications. Computed Tomography (CT) or Magnetic-Resonance Imaging (MRI) after battery removal is recommended when there are severe symptoms, evidence of mucosal injury, suspected perforation/fistulization, or delayed diagnosis (e.g., first confirmation or removal more than 12 hours after ingestion), because cross-sectional imaging helps assess mediastinal injury and proximity to major vessels.[1]

Emergency intervention and management timeframes

Management is highly time-sensitive. If ingestion is suspected, immediate two-view X-rays should be obtained. If the child is 12 months or older, the ingestion was likely within 12 hours, the child is stable and able to swallow, and perforation is not suspected, it is reasonable to administer 10 mL (2 teaspoons) of honey every 10 minutes for up to 6 doses en route to endoscopy. In a clinical setting, sucralfate suspension 1 g/10 mL may also be given as 10 mL every 10 minutes for up to 3 doses. These measures may reduce injury severity, but must never delay endoscopic removal.[1,9,10]

If a button battery is in the esophagus, immediate endoscopic removal is mandatory, ideally within 2 hours. The intervention should not be delayed for fasting status. Endoscopic inspection should document injury depth, location, and battery orientation, because these features guide risk stratification for airway and vascular complications.[1,2,9]

For batteries beyond the esophagus, management is more selective. In asymptomatic children, observation is often appropriate. However, retrieval should be considered if symptoms develop, if a magnet was co-ingested, or if a large battery persists in the stomach, especially in younger children. The National Capital Poison Center uses age- and size-based thresholds (for example, persistent ≥15 mm gastric batteries in children <6 years), whereas ESPGHAN allows observation in many asymptomatic cases with follow-up imaging; this should be presented as a guideline-dependent decision, not a single universal rule.[1,9]

After removal, if there is no perforation, the injured area may be irrigated endoscopically with 50–150 mL of 0.25% sterile acetic acid. This is a reasonable mitigation strategy, but the evidence base is limited and largely derived from animal/preclinical work and a very small pediatric series, so it should be described as an adjunct rather than a fully established standard.[1,9,11]

Clinical outcomes and complications

The most serious injuries are associated with esophageal impaction. In the Lisbon series, all patients with esophageal batteries had severe mucosal injury, acute complications occurred in more than half, and later stenosis was common. Severe tissue injury can occur within hours, but frank perforation is usually identified within 2 days, not necessarily within the first 2 hours.[1,2]

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Important complications include esophageal perforation, mediastinitis, tracheoesophageal fistula, recurrent laryngeal nerve injury/vocal cord paralysis, esophageal stricture, and aortoesophageal fistula. Delayed catastrophic bleeding remains a central concern: ESPGHAN notes that fistulas can present up to 4 weeks after removal, and the poison-center guideline reports that esophageal-vascular fistulas may present up to 27 days after removal. This justifies prolonged clinical vigilance, especially after mid-esophageal injury or any sentinel bleeding.[1,5,9,12]

CASE

A 2-year-old girl with trisomy 21 (Down syndrome) and a history of neonatal surgery for intestinal obstruction (restoration of bowel patency) was admitted in February 2026 to the Emergency Department of TSMU and Ingorokva High Medical Technology University Clinic due to unexplained oral bleeding and hemorrhagic shock.

Symptoms started 11 days before admission in the evening with the onset of crying and hypersalivation. The following morning, the patient was consulted by a primary care physician, who diagnosed a viral infection and discharged the patient home with appropriate recommendations (Day 0). However, the child subsequently refused food and fluids, continued to cry, and developed marked sialorrhea, followed by fever, prompting an ambulance call (112). The patient was hospitalized at the Pediatric Clinic on the second day of symptom initiation. The AP radiograph revealed a round, radiopaque, metallic-density shadow at the level of the neck. The patient was placed on mechanical ventilation, and direct laryngoscopy identified a coin-shaped ("button-like") foreign body at the upper esophageal constriction. The adjacent mucosa was covered with black, necrotic-appearing deposits and easily bled upon mechanical contact. The foreign body was removed using extraction forceps, with technical difficulty (Fig.1). Given the increased risk of esophageal perforation, advancing a flexible endoscope distal to the burn was deemed inappropriate. Following the procedure, the patient was transferred to the Pediatric Intensive Care Unit and, two days later, to the thoracic surgery department.

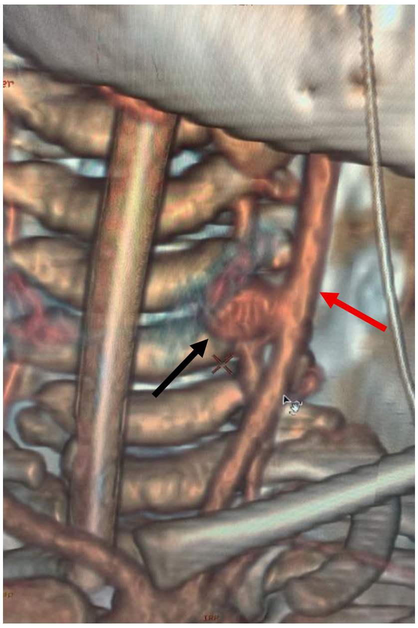
FIGURE 1. Extracted Lithium button battery

Patient was discharged due to clinical improvement (she tolerated small amounts of water and food) and was scheduled for follow-up esophagogoscopy in 3 weeks.

Two days after discharge, the patient developed vomiting with large volumes of blood and was admitted to the ICU of our clinic with signs of hemorrhagic shock, respiratory distress, stridor, and somnolence. After starting mechanical ventilation, hemostatic therapy, and infusion-transfusion resuscitation, hemodynamic stabilization was achieved, and active bleeding was no longer visualized.

The urgent CTA scan revealed radiologic signs of esophageal perforation, mediastinitis, and a pseudoaneurysm of the left common carotid artery at approximately the C5-C6 vertebral level (Fig.2).

FIGURE 2. 3D CTA reconstruction of the left common carotid artery (red arrow) pseudoaneurysm (black arrow)



Considering safety and a minimally invasive approach, especially after a massive bleeding episode, endovascular embolization of the aneurysm was selected as the preferred method of therapy.

Access was obtained via open surgery puncture of the right femoral artery using a 5F introducer. A guiding catheter, specifically a Cordis Envoy 5F, was positioned in the left common carotid artery. Digital subtraction angiography (DSA) confirmed a pseudoaneurysm of the left common carotid artery (LCCA), measuring approximately 7 mm in diameter, with a regular shape and a diverticulum at its apex (Fig.3A).

Using a microcatheter (Headway 17) and a microguidewire (Traxcess 14), the pseudoaneurysm was catheterized. Detachable coils were deployed inside the aneurysm sac (Fig.3B), including Microplex coils (Terumo) of sizes 7 mm/31 cm, 6 mm/20 cm, 5 mm/20 cm, 5 mm/15 cm, and 4 mm/12 cm. Final DSA demonstrated complete occlusion of the

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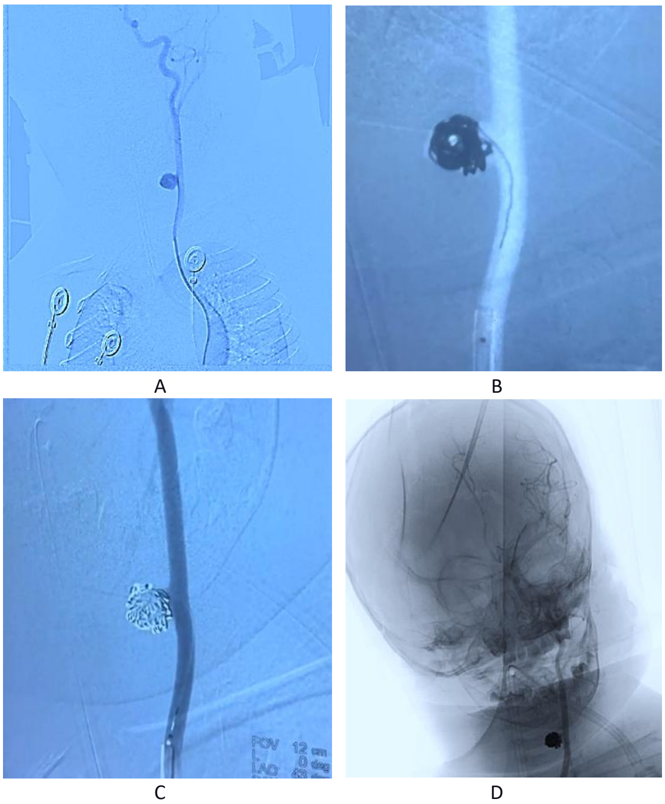
pseudoaneurysm from the circulation, with no complications (Fig.3C and 3D).

FIGURE 3. The left carotid artery pseudoaneurysm occlusion



Explanations: A. The left common carotid artery (LCCA) before intervention (CT angiography image); B. Detachable coils deployed inside the aneurysm sac; C and D. demonstrated complete occlusion of the pseudoaneurysm from the circulation without complications.

After endovascular closure, no further episodes of active hemorrhage were observed, and the patient's condition stabilized. Follow-up on esophageal healing, swallowing function, neurologic status, and surveillance imaging was planned.

DISCUSSION

There is no reliable published population incidence for carotid-esophageal fistula after button battery ingestion. The current literature does not provide a denominator-based rate for this specific lesion; instead, it is reported as an exceptionally rare vascular complication within case reports and small series.[13,14]

The best systematic review available found that, among 361 children with severe complications or death after button battery ingestion, 51% had vascular injuries. About 75% of those vascular injuries were aorto-esophageal fistulas, and the remaining minority were pooled as other non-aortic vascular lesions. That means the incidence of carotid-esophageal fistula was not separately quantified.[13,14]

Formation of the carotid pseudoaneurysm following button battery ingestion is extraordinarily rare, with the literature still at the level of isolated case reports:

- a pediatric case of left common carotid-esophageal fistula after button battery ingestion that later progressed to a pseudoaneurysm, treated with a flow-diversion stent,[14] and
- a separate 2025 pediatric case of catastrophic upper GI bleeding from a left common carotid pseudoaneurysm after button battery ingestion.[15]

The management of the pseudoaneurysm and associated fistula is usually multidisciplinary and staged: (i) bleeding control, (ii) vascular anatomy visualization, (iii) bridge technique if necessary, and (iv) vascular and esophageal damage repair.[16]

The repair of the vascular lesion depends on anatomy, contamination, and hemodynamic stability. Reported options include:

- Primary repair/oversewing of the arterial defect.[14]
- Patch repair (patch angioplasty), including bovine pericardial patch repair.[14]
- Segmental resection with reconstruction/anastomosis of the injured vessel.[14]
- Interposition graft replacement: (i) Polytetrafluoroethylene (PTFE)/Gore-Tex graft for carotid reconstruction, and (ii) Dacron / Gelweave graft for aortic repairs.[14]
- Covered endovascular stent-graft as emergency closure of the fistula or pseudoaneurysm, especially in unstable patients.[14,17]
- Flow-diversion stent for delayed carotid pseudoaneurysm after fistula repair.[14]

For carotid lesions, the key extra issue is cerebral perfusion:[14,17]

- Neuroangiographic assessment of collateral flow / Circle of Willis is important before accepting carotid sacrifice.
- If collateral flow is inadequate, carotid reconstruction/preservation is favored over simple sacrifice.

According to the systematic review, the most common site of button battery ingestion was the upper esophagus in 47% of total cases, which was also associated with the highest percentage of non-fatal outcomes, with 86.9% survival rate.[13] The same location was identified in our patient.

As it was mentioned, cerebrovascular events may be one of the serious complications of bleeding itself and intraoperative cerebral hypoperfusion as well.[15] Despite the severity of bleeding, rare localization of the pseudoaneurysm/fistula, and intervention carried out under extreme conditions, there were no cerebrovascular complications in our case.

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CONCLUSIONS

In toddlers, unwitnessed button battery ingestion can culminate in delayed, life-threatening vascular injury even after apparent recovery. Recurrent or massive bright-red hematemesis after esophageal button battery injury should be treated as a sentinel sign warranting urgent vascular imaging (CTA/angiography) and multidisciplinary management planning. Endovascular closure of a carotid-esophageal fistula can be lifesaving in selected patients.

INFORMED CONSENT

Written informed consent for publication was obtained from the patient's legal guardian, and all identifying details were removed/modified to protect privacy.

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