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Impending esophago-arterial fistula after battery ingestion—First preventive operation on a toddler worldwide

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Medical history

A 3-year-old toddler was admitted to an emergency department because he had recently swallowed a button cell battery. The child had coughed for a while afterwards and was then free of symptoms. An otorhinolaryngological examination of the larynx did not reveal a foreign body. The toddler was transferred to our pediatric hospital around 3h after the ingestion.

Initial measures

The child presented completely free of any complaints or symptoms. Due to the observed swallowed button cell battery, 10 ml of sucralfate 10% was immediately administered per os and an X-ray was taken, showing the button cell battery in the upper esophageal sphincter. The button cell was immediately retrieved using Magill forceps with the patient under deep sedation and visualization with a video laryngoscope. During this procedure, laterally pronounced burns of the esophageal tissue was revealed.

Course

In accordance with the standard in our pediatric hospital, a magnetic resonance imaging (MRI) scan was performed after 2 days to show the typical panesophagitis and possible fistulous tracts forming within it [1]. This showed an inflammatory edematous distended esophagus with duct-forming ulcerations up to the wall of the left common carotid artery (ACC). Sonographically, a clear barrier between this duct and the ACC could no longer be visualized (**Fig. 1**).

We immediately convened an interdisciplinary case discussion (pediatric anesthesia, pediatric surgery, pediatric radiology, pediatric intensive care medicine, vascular surgery and plastic surgery). As an acute connection of the impending fistula to the ACC is likely to result in a high mortality rate, the decision to perform an immediate surgical exploration is made by interdisciplinary consensus with the parents.

Operation

A cervical left paramedian transverse incision was made at the level of the previously sonographically marked ulceration.

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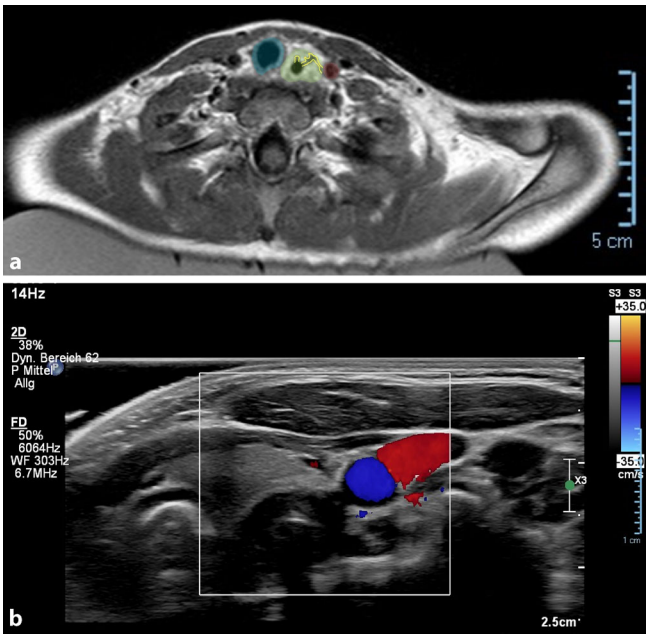

Fig. 1 ◄ **a** Preoperative magnetic resonance imaging (MRI) of transversal axis. Trachea (*blue*), edematous esophagus (*green*) with two duct-forming ulcerations (*yellow lines*), one of which extends into the vicinity of the common carotid artery (ACC, *red*). **b** Sonography with color-coded duplex sonography of the esophageal wall without recognizable separating structures to the ACC (color duplex, right *blue*, internal jugular vein *red*)

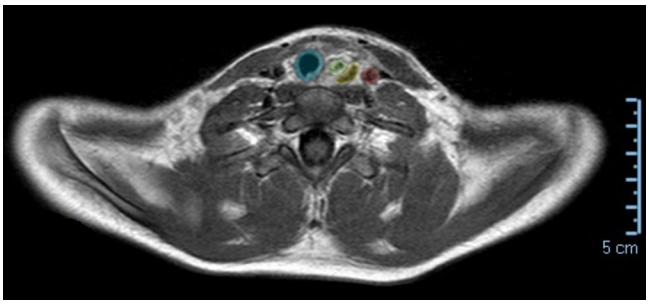

Fig. 2 ◄ Postoperative MRI of transversal axis. Trachea (*blue*), oesophageal wall thickened significantly less (*green*), collagen fleece (*yellow*) between esophagus and ACC (*red*)

Under endoscopic control, the esophagus was exposed in the area of the ulcer, the muscularis and serosa were intact. The adjacent ACC was isolated from the esophagus and a protective barrier was inserted using a bovine pericardial patch and a collagen fleece, and a transnasally positioned gastric tube was placed endoscopically.

Postoperative course, discharge and aftercare

The gastric tube was extubated and removed after 12 h with normal clinical and laboratory findings. In a repeat MRI on the second postoperative day, the edema of the esophagus was reduced and the surgically inserted barrier to the ACC was clearly visible (◘ **Fig. 2**). The infant could be discharged home on the third postoperative day in an unimpaired general condition and after a full diet. At the planned esophagoscopy after 2 weeks, only two small scarred areas were visible, which will certainly not obstructively heal.

Discussion

In all industrialized countries, an increasing incidence of serious injuries due to the ingestion of button cell batteries is observed, which can be explained both by their increasing prevalence and their greater energy capacity [5]. In the esophagus, the current flow triggers electrical hydrolysis, which leads to severe colliquation necrosis after a short time [9]. Possible complications include perforations, tracheoesophageal fistulas and vocal cord paresis. Fatalities are mainly reported due to fistulas in arteries [6]. The constantly updated website of the US National Poison Control Center currently reports 280 cases with serious complications and 71 deaths (as of September 2024 [6, 7]).

The first important immediate measure is the immediate administration of sucralfate[1] or honey[2] [4] to reduce the consequences of the chemical burn. In various reviews [2, 3, 4] it is discussed whether to perform repeated MRI examinations "in case of injuries near the aorta". Consequently, the involvement of cardiac and thoracic surgery and an increased availability to perform emergency surgery are mentioned. Clear advice on preventive surgery, as performed in our case, cannot be found in the literature so far; however, because acute breakthrough of duct-forming ulcers into the vascular system is usually fatal, even with balloon catheter placement in the esophagus, transluminal vascular catheter procedures and even with immediate surgical exposure [6, 8], we consider our approach to be the only correct decision in a comparable case.

Practical conclusion

Sucralfate or honey should be administered immediately wherever children present within the first 12 h after a button cell battery ingestion. In addition, the battery must be retrieved as quickly as possible., usually with a laryngoscope and suitable forceps from the upper esophagus In the case of visible burns to the esophagus, we recommend MRI imaging in the following days and preventive surgical isolation of the inflammatory process in the case of pronounced ulcers that are dangerously close to blood vessels. For follow-up care, children should therefore be transferred to an institution where the recommended procedure can be carried out. We recommend the updated version of the S2k guidelines on foreign body aspiration and ingestion in children, which will be published on the Association of the Scientific Medical Societies in Germany (AWMF) website in the near future.

[1] Sucralfate suspension with 1 g/10 ml, drink 10 ml every 10 min up to three times.

[2] 10 ml honey every 10 min up to 6 doses (not for infants).

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Declarations

Conflict of interest. J. Lohmann, T. Klein, M. Stenzel, M. Aleksic, P. Fuchs, T. Boemers and J. Kaufmann declare that they have no competing interests.
Ethical standards. For this article no studies with human participants or animals were performed by any of the authors. All studies mentioned were in accordance with the ethical standards indicated in each case. For images or other information within the manuscript which identify the patient, consent was obtained from the legal guardians.

References

1. Kaufmann J, Grozeva B, Laschat M et al (2021) Rapid and safe removal of foreign bodies in the upper esophagus in children using an optimized Miller size 3 video laryngoscope blade. Paediatr Anaesth 31:587–593
2. Kramer RE, Lerner DG, Lin T et al (2015) Management of ingested foreign bodies in children: a clinical report of the NASPGHAN Endoscopy Committee. J Pediatr Gastroenterol Nutr 60:562–574
3. Lerner DG, Brumbaugh D, Lightdale JR et al (2020) Mitigating Risks of Swallowed Button Batteries: New Strategies Before and After Removal. J Pediatr Gastroenterol Nutr 70:542–546
4. Litovitz T, Whitaker N, Clark L et al (2010) Emerging battery-ingestion hazard: clinical implications. Pediatrics 125:1168–1177
5. National Capitol Poison Center (2024) Fatal Button Battery Ingestions: 71 Reported Cases. https://www.poison.org/battery/fatalcases. Zugegriffen: 4. Sept. 2024
6. National Capitol Poison Center (2024) Nonfatal Button Battery Ingestions with Severe Esophageal or Airway Injury: 280 Cases. https://www.poison.org/battery/severecases. Zugegriffen: 4. Sept. 2024
7. Pae SJ, Habte SH, Mccloskey JJ et al (2012) Battery ingestion resulting in an aortoesophageal fistula. Anesthesiology 117:1354
8. Shaffer AD, Jacobs IN, Derkay CS et al (2021) Management and Outcomes of Button Batteries in the Aerodigestive Tract: A Multi-institutional Study. Laryngoscope 131:E298–E306
9. Kaufmann J et al (2024) S2k-LL 001/031 Fremdkörperaspiration und Ingestion im Kindesalter. https://www.awmf.org/