

Button Cell Ingestion in Infants: A Report of Five Cases

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Abstract

Button cell ingestion is a common household accident among infants, often leading to serious complications that require immediate diagnosis and urgent removal. We report five cases of button cell ingestion involving infants aged between 9 and 32 months, including four boys and one girl. The ingestion was accidentally discovered in two infants, while in the other three, it was suspected during play. In three cases, mothers attempted to induce vomiting by giving fluids, but the batteries remained in the digestive tract for 38 hours to 5 days. After confirming the diagnosis, the batteries were removed within 4 to 36 hours. The locations of the cells were the esophagus in two cases, the cardia in one, the stomach in one, and the bowel in one. One case involved a large cell in the esophagus, while the others involved smaller cells. Complications occurred in four cases, including esotracheal fistula, esophageal ulceration, and perforation of the jejunum and caecum. In one case, the digestive mucosa appeared normal upon endoscopy. One patient died.

Keywords

Button Cell, Domestic Accident, Infant

1. Introduction

Foreign body ingestion is a common domestic accident in pediatrics [1]-[3]. In the last twenty years, button cell ingestion has emerged as a new type of domestic accident [4] [5]. Due to technological advancements, the widespread use of

button batteries in daily objects and miniaturized toys has resulted in an increase in button battery ingestion incidents [3] [6].

Small-diameter batteries may pass through the gastrointestinal tract and be excreted after a few days or may cause digestive complications, which often leads to their discovery [2] [7]. Batteries larger than 20 mm in diameter are likely to become lodged in the esophagus and cause varying degrees of esophageal damage [2] [7] [8].

Injuries can occur through various mechanisms, including caustic (from the release of alkaline electrolytes), electrical (burns from generating electric power in contact with moist mucosa), mechanical (necrosis due to mucosal compression), and thermal or toxic effects (local absorption of lithium or mercury from the battery). Even when flat, a button battery poses a danger if ingested, capable of causing the same types of injuries as when charged [2] [5] [9].

Since 2006, cells with larger diameters and higher voltages have been developed. The risk of these being lodged in the esophagus after ingestion is higher [5] [7] [10]. Consequently, over the past decade, there has been an increase in serious cases with high morbidity and mortality rates [3] [6].

We report five cases of button cell ingestion in infants at the pediatric department of Dakar Principal Hospital.

2. Observation

2.1. Observation 1

A 32-month-old boy was brought to our department after swallowing a button cell from a watch. The incident happened while he was playing with electronic toys. Due to the child's excessive drooling and a missing battery in one of the toys' compartments, the mother suspected he had ingested a button battery. She gave him water, which caused him to vomit three times, but the button cell was not expelled. They sought medical attention in our department 3 hours post-incident. The physical examination upon admission was unremarkable. A thoraco-abdominal X-ray revealed a round opacity at the cardia level. An endoscopy conducted 7 hours after the X-ray enabled the removal of a small button cell adhered to the cardia, revealing ulceration in the middle and lower third of the esophagus. A nasogastric tube was inserted. The patient received antibiotic and anti-secretory therapy, resulting in a positive outcome. He was discharged 15 days after admission with normal feeding resumed.

2.2. Observation 2

A 9-month-old male infant was brought in for accidental ingestion of a button cell while playing with a television remote. The mother suspected the accident after the child suddenly vomited and unsuccessfully tried to induce further vomiting by giving him water. She sought medical attention in our department 2 hours post-incident. Upon admission, the examination was significant. A thoraco-abdominal X-ray revealed a round opacity in the stomach. Due to technical

constraints preventing a digestive endoscopy, the button cell was surgically removed 26 hours after diagnosis. The gastric mucosa appeared normal, and the child received antibiotic therapy. He was discharged 7 days following admission.

2.3. Observation 3

A 24-month-old male infant was transferred to our department for obstructive syndrome. The symptoms, which included abdominal pain and vomiting, had progressed over 72 hours. Thoraco-abdominal X-ray revealed air-fluid levels and a round bowel opacity (**Figure 1**). The laparotomy, performed 8 hours later, revealed a small button cell in the bowel, a jejunocolic perforation, and a purulent liquid effusion in the peritoneal cavity (**Figure 2**).



Figure 1. Air-fluid levels and a rounded intestinal opacity suggest an occlusive syndrome due to a battery cell.



Figure 2. Jejunocolic perforation caused by a small-diameter battery cell.

The button cell removal involved a jejunal resection-anastomosis, a caecal suture, and peritoneal cavity lavage-drainage, resulting in a favorable outcome. The child was discharged 10 days post-admission.

2.4. Observation 4

A 14-month-old male infant was referred following an unsuccessful attempt to remove an esophageal button battery. The battery was incidentally discovered on a chest X-ray, prompted by symptoms of vomiting and excessive salivation that began 5 days prior. An endoscopy performed 4 hours after admission revealed the battery lodged in the esophageal mucosa, causing superficial ulceration without perforation. A nasogastric tube was placed for feeding, and the child was treated with antibiotics for 7 days. He was discharged after a 10-day hospital stay.

2.5. Observation 5

A 13-month-old female infant with a gastrostomy feeding tube was admitted to our department with a cough. She had ingested a large button cell located in the esophagus (**Figure 3**) two weeks prior. The accident occurred while she was playing with a portable radio, during which she opened the battery compartment and accidentally ingested the battery. Battery ingestion was suspected due to vomiting, hypersalivation, and an open, empty battery compartment of the radio. Despite attempts to expel the battery through induced vomiting from water and milk given by the mother, these were unsuccessful. The child sought medical attention 2 hours after the incident. An attempt to remove the battery 36 hours after diagnosis with a rigid endoscope led to an esophageal perforation, necessitating a feeding gastrostomy. The physical examination upon admission showed dehydration, mild malnutrition, and bilateral bronchial congestion, though the chest X-ray was normal. The barium swallow test (BST) indicated a bronchogram suggestive of an esotracheal fistula (**Figure 4**). Upper gastrointestinal endoscopy confirmed the presence of a 10 mm fistula, located 2 cm from Killian's mouth (**Figure 5**). A feeding jejunostomy was performed, and the gastrostomy was closed (**Figure 6**). The decision was made to close the fistula endoscopically. The fistula's edges were resected and sealed with two clips. A BST on day 15 revealed partial closure of the fistula, with a right-sided bronchogram still present (**Figure 7**). The patient ultimately died due to inhalation pneumonitis.



Figure 3. Large battery cell located in the esophagus.



Figure 4. Bronchogram visualized on BST indicating an esotracheal fistula.



Figure 5. Esotracheal fistula of 10 mm in diameter was observed during digestive endoscopy.



Figure 6. Feeding jejunostomy performed after gastrostomy closure.



Figure 7. Right-sided bronchogram on follow-up BST suggests a partial closure of the esotracheal fistula.

Table 1 summarizes the characteristics of the patients and the ingested batteries.

Table 1. Characteristics of children and ingested button cells.

Case	Sex	Age (months)	Ingested battery cell							
			Origin	Size	location	Length of stay	Time of extraction after diagnosis	Initial symptoms	Attitudes of mothers	Complications
1	M	32	Clock	Small	Cardia	10 h	7 h	Hypersalivation	Water administration	Esophageal ulceration
2	M	9	TV remote	Small	Stomach	28 h	26 h	Vomiting	Water administration	
3	M	24	Unknown	Small	Intestine	+72 h	8 h	Occlusive syndrome		Intestinal perforation
4	M	14	Unknown	Small	Esophagus	+5 jours	4 h	Vomiting Hypersalivation		Esophageal ulceration
5	F	13	Portable radio	Large	Esophagus	38 h	36 h	Vomiting Hypersalivation	Water and milk administration	Eso-tracheal fistula Death

3. Discussion

Domestic accidents are a common reason for pediatric consultations. Over the last two decades, there has been an increase in accidents involving the ingestion

of button cells, driven by the widespread use of electronic devices and the miniaturization of their batteries [4] [5].

In the United States and France, the number of button cell ingestion cases is steadily increasing. From 1999 to 2019, the United States National Poison Data System reported a 66.7% annual increase in cases and a 10-fold increase in complications [3] [4]. In France, Lhamar *et al.* reported a 7-fold increase in cases between 2011 and 2013 [2]. In Africa, the incidence of button cell ingestion is not well-known due to underreporting of domestic accidents, with only isolated cases or small series reported.

The age range for the occurrence of the accident is 14 to 36 months, with a median of 26 months, corresponding to when infants explore their environment and body [5]. There is a predominance of males [2] [11]. Our patients were aged between 9 and 32 months and consisted of 4 boys and 1 girl.

The clinical presentation of button cell ingestion is nonspecific, ranging from asymptomatic to life-threatening situations [5] [12]. Symptoms are not unique and can occur in other conditions [7] [13] [14].

Symptoms primarily arise from button cells lodged in the esophagus for hours [15]. Sudden onset of excessive salivation, vomiting, difficulty swallowing, refusal to eat, painful swallowing, or unexplained fever in a healthy young boy should prompt consideration of foreign body ingestion, particularly a button cell in the esophagus [7] [14] [15]. In our patients, vomiting and excessive salivation were the most common symptoms.

Button cell ingestion may go unnoticed and only be discovered when it appears in the feces or during complications [2] [7]. In two of our patients, the button cell was incidentally discovered during an X-ray. According to the authors, some cases of button cell ingestion with esophageal location manifest through respiratory distress [1] [16].

Chest X-ray, covering neck and abdominal regions, is the primary diagnostic tool. It confirms the presence, location, size, and appearance of the button cell [14] [17]. It also aids in differentiating between button cell ingestion and the ingestion of other flat, round metal objects like coins. On an X-ray, a button cell shows as a round opacity with a clear halo around it, creating a double-contour appearance, distinguishing it from a coin [5] [8]. Button cells can lead to complications. The injury mechanisms include direct pressure on the mucosa causing pressure necrosis, release of toxic substances after fragmentation, and electric power generation upon contact with moist mucosa. The generated electric power causes a water hydrolysis reaction, primarily at the button cell's negative terminal (anode), producing hydroxide ions. The resulting highly basic pH, due to hydroxide ions, causes burn lesions with necrosis and liquefaction of adjacent tissues [2] [5] [9]. Prolonged lodging of a button cell can lead to ulceration or perforation of the esophagus, potentially resulting in an esotracheal fistula, esoaortic fistula, or esophageal stenosis. Other reported complications include vocal cord paralysis, mediastinitis, tracheal stenosis, tracheomalacia, spondylodiscitis, and pulmonary haemorrhage [7] [8].

The type and size of the ingested button cell, along with the patient's age, affect the likelihood of complications [14] [18]. Lithium button cells, due to their high voltage, and those 20 mm or more in diameter, are particularly dangerous as they are likely to become lodged in the esophagus, especially in children under 6 years of age [4] [19]. The duration of contact between the button cell and the esophageal mucosa is a key factor in the development of complications. Many experts concur that esophageal lesions can develop after 1 to 2 hours of contact, and perforations can occur in less than 6 hours [5] [7] [20]. In our patients, the duration of the button cell's stay was at least 38 hours, with a maximum of 5 days. Complications included esophago-tracheal fistula, esophageal ulceration, and jejunocecal perforation. A button cell found in the stomach might have previously been impacted in the esophagus [10]. In one case of gastric button cell ingestion, oesophageal ulceration was noted, while in another, the mucosa appeared normal upon endoscopy.

Ingesting a button cell can lead to life-threatening complications, making it both a diagnostic and therapeutic emergency [2]. Diagnosing such ingestions can be difficult without a witness. Moreover, parents often lack information on the dangers of swallowing button cells and the immediate steps to take. Inducing vomiting or feeding the child is not recommended. Administering honey and/or sucralfate orally, at a dose of 10 ml every 10 minutes for 12 hours after ingestion, is advised [8]. The fact that the child is not fasting, including the ingestion of honey or sucralfate, should not limit anesthesia for upper gastrointestinal endoscopy [8] [21]. In our study, three mothers administered fluids (milk or water) to induce vomiting, delaying consultation. The button batteries were removed 4 hours or more after diagnosis, up to a maximum of 36 hours. The delay in diagnosis and treatment may stem from the non-specific initial symptoms or healthcare staff's lack of awareness of the severity and urgency of button cell ingestion. In countries with limited healthcare resources, treatment delays are sometimes caused by the absence of appropriate technical facilities for button cell removal in some health facilities. Delayed complications can sometimes occur despite early removal of the battery. Strictures and fistulas have been reported several weeks and even several months after the removal of the button cell. [4] [5] [9]. Numerous deaths have been reported in medical literature, primarily due to complications from esophageal perforation [20]. In our patients, the outcome of button cell ingestion complicated by an esotracheal fistula was poor. Despite attempts to close the fistula, death occurred due to inhalation pneumonitis. However, after more than a year of follow-up, no complications were noted in the other patients.

The ingestion of button batteries significantly affects morbidity and mortality, burdening individuals, families, society, and the economy. Complications like esophago-tracheal fistulas, esophago-aortic fistulas, and strictures are particularly challenging to manage in settings with limited technical facilities. Nutritional support, including enteral nutrition through feeding gastrostomy or jejunostomy, can have psychosocial repercussions and impair the quality of life for

patients and their families.

Preventing the ingestion of button batteries in children is essential and must be a public health priority [3]. Campaigns aimed at the general population and early childhood professionals about the dangers of button battery ingestion can help decrease its occurrence. Educating parents on immediate actions following ingestion and what to avoid is crucial for preventing complications. Training for health professionals is essential to prevent diagnostic and treatment delays. Manufacturers also play a critical role in prevention. Public authorities should collaborate with industrial federations to secure voluntary commitments to enhance product safety and consumer awareness about the risks of button battery ingestion, including an infographic in the packaging. Retail packaging with solid blisters and individual packaging, rather than packets, would significantly lower the risk of ingestion [2]. Device and toy battery compartments must be securely closed, preferably with screws, to prevent children's access. Manufacturers should also encourage the production and use of batteries smaller than 15 mm in diameter.

4. Conclusions

Button cell ingestion is a new type of domestic accident characterized by potentially severe complications with high morbidity and mortality. Deaths often occur due to the esophageal location of button cells larger than 20 mm in diameter.

Preventing button battery ingestion in children should include ensuring safer access to battery compartments, raising awareness among families and early childhood staff about the risks.

Educating families on the reflexes to adopt and the actions to avoid in case of button battery ingestion, as well as informing and training medical staff, would help prevent harmful delays in consultation and care.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Kaboré, A., Sanou, M., Nagalo, K., Tientrebeogo, C., Dao, L., Gyébré, Y., *et al.* (2019) Complications des corps étrangers à piles-boutons chez l'enfant: À propos de deux cas. *Journal de Pédiatrie et de Puériculture*, **32**, 35-38. <https://doi.org/10.1016/j.jpp.2018.11.004>
- [2] Lahmar, J., Célérier, C., Garabédian, E.N., *et al.* (2018) Lésions oesophagiennes consécutives à l'ingestion de piles boutons chez l'enfant: Analyse des causes et propositions de mesures préventives. *Annales européennes d'oto-rhino-laryngologie, maladies de la tête et du cou*, **135**, 88-93. <https://doi.org/10.1016/j.aforl.2017.06.004>
- [3] Sola, C., Pico, J. and Dadure, C. (2022) Ingestion de corps étrangers chez l'enfant: Mise au point et nouveautés. *Anesthésie & Réanimation*, **8**, 566-575. <https://doi.org/10.1016/j.anrea.2022.08.002>
- [4] Zipursky, A.R. and Ratnapalan, S. (2021) Ingestion de piles boutons chez les en-

- fants. *Canadian Medical Association Journal*, **193**, E1822-E1823.
<https://doi.org/10.1503/cmaj.210572-f>
- [5] Lorenzo, C., Azevedo, S., Lopes, J., Fernandes, A., Loreto, H., Mourato, P., et al. (2022) Battery Ingestion in Children, an Ongoing Challenge: Recent Experience of a Tertiary Center. *Frontiers in Pediatrics*, **10**, Article 848092.
<https://doi.org/10.3389/fped.2022.848092>
- [6] Nisse, P., Lampin, M.E., Aubry, E., Cixou, E. and Mathieu-Nolf, M. (2016) Ingestion d'une pile bouton compliquée d'une fistule œso-aortique fatale. Proposition d'un algorithme de prise en charge chez l'enfant de moins de 6ans. *La Presse Médicale*, **45**, 947-953. <https://doi.org/10.1016/j.lpm.2016.07.016>
- [7] Wang, H., Hu, S., Lin, K.J. and Chen, A. (2022) A Novel Approach to Button Battery Removal in a Two-And-Half Year-Old Patient's Esophagus after Ingestion: A Case Report. *BMC Pediatrics*, **22**, Article No. 96.
<https://doi.org/10.1186/s12887-022-03142-3>
- [8] Mubarak, A., Benninga, M.A., Broekaert, I., Dolinsek, J., Homan, M., Mas, E., et al. (2021) Diagnosis, Management, and Prevention of Button Battery Ingestion in Childhood. *Journal of Pediatric Gastroenterology and Nutrition*, **73**, 129-136.
<https://doi.org/10.1097/mpg.0000000000003048>
- [9] Sethia, R., Gibbs, H., Jacobs, I.N., Reilly, J.S., Rhoades, K. and Jatana, K.R. (2021) Current Management of Button Battery Injuries. *Laryngoscope Investigative Otolaryngology*, **6**, 549-563. <https://doi.org/10.1002/lio2.535>
- [10] Ing, R.J., Hoagland, M., Mayes, L. and Twite, M. (2017) The Anesthetic Management of Button Battery Ingestion in Children. *Canadian Journal of Anesthesia*, **65**, 309-318.
<https://doi.org/10.1007/s12630-017-1023-9>
- [11] Park, S. and Burns, H. (2022) Button Battery Injury: An Update. *Australian Journal of General Practice*, **51**, 471-475. <https://doi.org/10.31128/ajgp-03-21-5873>
- [12] Traoré, D., Yaro, I., Fouraiji, K., et al. (2017) Accidental ingestion of batteries in children. *Journal of Applied Science and Research*, **5**, 42-44.
- [13] Krom, H., Visser, M., Hulst, J.M., Wolters, V.M., Van den Neucker, A.M., de Meij, T., et al. (2018) Serious Complications after Button Battery Ingestion in Children. *European Journal of Pediatrics*, **177**, 1063-1070.
<https://doi.org/10.1007/s00431-018-3154-6>
- [14] Lanzafame, L.R.M., Blandino, A., Cicero, G., Romeo, P., Agati, S., Zanai, R., et al. (2022) Diagnosis and Management of Button Battery Ingestion Complicated by Tracheo-Esophageal and Aorto-Esophageal Fistulas. *Diagnostics*, **12**, Article 2369.
<https://doi.org/10.3390/diagnostics12102369>
- [15] Alhawsawi, S.A., Alshamrani, A.S. and Muhammad, T. (2022) A2 Years Old Boy with Recurrent Tracheoesophageal Fistula after Surgical Removal of an Esophageal Button Battery. *American Journal of Case Reports*, **23**, e937810.
<https://doi.org/10.12659/ajcr.937810>
- [16] Chouaib, N., Rafai, M., Belyamani, L., Dimou, M., El Koraichi, A., El Haddoury, M., et al. (2014) Esophageal Foreign Body Revealed by Respiratory Distress. *Revue de Pneumologie Clinique*, **70**, 245-247. <https://doi.org/10.1016/j.pneumo.2013.05.009>
- [17] Nao, E., Ndiaye, M., Loum, B., et al. (2010) Les corps étrangers œsophagiens dangereux: L'exemple des piles boutons. *Journal africain de chirurgie digestive*, **10**, 1032-1035.
- [18] Lukish, A.C., Pat, V., Apte, A. and Levitt, M.A. (2022) Battery Ingestion with Colonic Perforation after Colostomy Closure in a Toddler. *European Journal of Pedi-*

- atric Surgery Reports*, **10**, e41-e44. <https://doi.org/10.1055/s-0041-1741558>
- [19] Riedesel, E.L., Richer, E.J., Sinclair, E.M., Sauer, C.G., Santore, M.T., Simoneaux, S.F., et al. (2020) Serial MRI Findings after Endoscopic Removal of Button Battery from the Esophagus. *American Journal of Roentgenology*, **215**, 1238-1246. <https://doi.org/10.2214/ajr.19.22427>
- [20] Labadie, M. and Tournoud, C. (2019) Avis relatif à la prise en charge initiale d'un appel pour toute suspicion d'ingestion de pile bouton par un jeune enfant. *Toxicologie Analytique et Clinique*, **31**, 7-11. <https://doi.org/10.1016/j.toxac.2018.12.005>
- [21] Heresbach, D., Dray, X. and Bories, E. (2017) Endoscopie gastro-intestinale pédiatrique. *Acta Endoscopica*, **47**, 227-231. <https://doi.org/10.1007/s10190-017-0627-9>