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Case Report

Delayed Management of a Button Battery Foreign Body in the Esophagus: A Case Report

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A B S T R A C T

Abstrak

Pendahuluan: Tertelan benda asing dan aspirasi benda asing umumnya terjadi pada anak-anak berusia antara 6 bulan hingga 6 tahun. Benda yang umumnya tertelan oleh anak-anak adalah benda-benda yang kecil dan berkilau, seperti baterai cakram dan magnet yang meningkat pesat selama dekade terakhir. Tertelannya baterai cakram merupakan keadaan darurat bedah yang membutuhkan ekstraksi segera, keterlambatan diagnosis menyebabkan kemungkinan komplikasi seperti peradangan, nekrosis pada mukosa esofagus dan perforasi esofagus. Esofagoskopi merupakan pilihan utama dalam tatalaksana benda asing esofagus.

Laporan Kasus: Dilaporkan satu kasus benda asing baterai cakram di esofagus pada seorang anak perempuan berusia 4 tahun dengan keluhan utama merasa ada yang mengganjal di tenggorok sejak 3 hari sebelum masuk rumah sakit dan pasien dilakukan rontgen toraks. Esofagoskopi dilakukan untuk mengeluarkan benda asing di esofagus. Pada saat evaluasi ditemukan jaringan nekrosis dan ekskoriasi pada esofagus setinggi 18 cm dari incisivus.

Kesimpulan: Keterlambatan dalam diagnosis dan penatalaksanaan benda asing di esofagus menyebabkan manifestasi klinis yang parah dan dapat menyebabkan komplikasi. Esofagoskopi menjadi pilihan untuk benda asing di esofagus karena visualisasinya yang baik.

Kata Kunci: baterai cakram, benda asing, keterlambatan diagnosis, esofagoskopi

What is already known?

An overview of delays in diagnosing and managing foreign bodies in the esophagus.

What does this study add?

Ingestion of chemical foreign bodies in the esophagus can cause damage to the esophageal mucosa due to the corrosive nature of the chemicals.

Abstract

Introduction: *Foreign body ingestion and aspiration commonly affect children between 6 months and 6 years. Items commonly swallowed by children are small and shiny objects, such as button batteries and magnets, which have increased rapidly over the last decade. Button battery ingestion is an established surgical emergency, requiring immediate removal. Diagnosis delays can lead to complications such as inflammation, necrosis of the esophageal mucosa, and esophageal perforation. Rigid esophagoscopy is the mainstay procedure for managing foreign bodies in the esophagus.*

Case Report: *A case of foreign body battery in the esophagus was reported in a 4-year-old girl with the chief complaint of feeling something stuck in the throat for 3 days before admission, and the patient underwent a thoracal x-ray. Esophagoscopy was performed to remove a battery foreign body in the esophagus. At the time of evaluation, necrosis and excoriation were found in the esophagus as high as 18 cm from the incisors.*

Conclusions: *Delay in diagnosis and management of foreign battery in the esophagus could lead to severe clinical manifestations and could cause complications. Esophagoscopy remains the mainstay of management of foreign bodies in the esophagus because of its good visualization.*

Keywords: *button battery, foreign body, delay diagnosis, esophagoscopy*

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Introduction

Foreign body ingestion is an emergency in otorhinolaryngology. The definition of ingested esophageal foreign body is a sharp or blunt object or food that has stuck and pinched in the esophagus due to ingestion, either intentionally or unintentionally. Foreign body ingestion is common in children, but is also seen among adults. Foreign bodies due to nonfood objects are common in children than in adults, especially those 6 months to 6 years old.[1] Many kinds of objects are found in such cases, including coins, fish bones, pins, button batteries, magnets, household items, etc. In some areas, batteries were commonly swallowed by children.[1,2]

The most recent report from the American Association of Poison Control Centers' National Poison Data System 2018 showed 66,519 foreign body ingestions in children aged 5 years and younger. Ingestion of more hazardous items like button batteries and magnets has increased over the last decade, mainly due to the increasing availability of electronic household items requiring button batteries like watches, hearing aids, calculators, and many more.[3,4]

A foreign body of a button battery in the esophagus was diagnosed based on history, clinical signs, physical examination, and radiographic examination. Delays in diagnosing a foreign body in the esophagus may cause damage to the pharynx and esophagus, leading to complications. Button batteries or small disk batteries can cause very rapid damage to the esophagus, resulting in perforation or fistula due to pressure necrosis, electrical discharge, or chemical injury.[4,5]

Esophagoscopy management within 24 hours can reduce complications. Rigid and flexible endoscopy are regarded as interventions for removing foreign bodies. Rigid endoscopy intervention is safe and straightforward but requires general anesthesia.[6]

Anatomy

The esophagus is a muscular tube-like organ that originates from endodermal primitive gut, 25–28 cm long, approximately 2 cm in diameter, located between the lower border of the pharynx's laryngeal part and the stomach's cardia. It can be divided, for descriptive purposes, into cervical, thoracic, and abdominal parts.[7,8]

Esophageal venous occurs following the arteries that supply blood vessels. Lymph vessels in the submucosal layer run longitudinally and drain into the celiac lymph nodes. The innervation of the esophagus is obtained from the vagus nerve.[7,9]

The normal pediatric esophagus consists of a thin-walled structure that can be readily identifiable on helical CT images of the chest and upper abdomen, but the esophagus can be difficult to visualize in its entirety unless the lumen is opacified with fluid or air. When the esophagus is adequately distended, wall thickness should be no more than five mm.[10]

The wall of the esophagus is made up of four discrete layers. The four histological layers: mucosa, submucosa, muscular propria, and adventitial layers.[7,10]

Classification

Ingested foreign bodies can be classified based on the location of the foreign body in relation to the anatomical location of the esophagus. Foreign bodies ingested can be divided into the first narrowing at the level of the 6th cervical vertebral cricopharyngeal, the second narrowing at the level of the 4th thoracic vertebral aorta, the third narrowing at the 5th thoracic vertebral bronchus branching, and the fourth narrowing is the diaphragm at the 10th thoracic vertebra. The most common esophageal foreign body location was the first stricture.[11]

The grade of esophageal injury can be determined by endoscopic appearance and risk of stricture formation, as shown in Table 1.

The time to use upper endoscopy depends on the patient's age and body, shape, and location of the foreign body. The American Society of Gastrointestinal Endoscopy (ASGE) has divided the removal of foreign bodies into emergent endoscopic removal, urgent endoscopic removal, and non-urgent endoscopic removal. The time for endoscopic removal is as follows:[13]

1. Emergency (immediate)
   - Esophageal obstruction
   - Disk battery in the esophagus
   - Sharp pointed objects in the esophagus
2. Urgent (in 24 hours)
   - Esophageal objects that are not sharp and pointed
   - Esophageal food impaction without complete obstruction
   - Objects >6 cm at or above the duodenum
   - Magnets within endoscopic reach

3. Non-urgent
   - Coins
   - Objects in stomach > 2.5 cm in diameter
   - Disk and cylindrical batteries in the stomach that can be observed up to 48 hours if asymptomatic (if longer than 48 hours, these batteries should be removed).

Table 1. Zasgar Grading of Esophageal Injury[14]

Grade	0	I	IIA	IIB	IIIA	IIIB
Endoscopic Appearance	No evidence of injury	Mucosal erythema and oedema	Superficial non-circumferential erosion, ulcers, haemorrhage, or exudate	Deep or circumferential ulceration	Multiple scattered ulcerations with patchy necrosis (brown, black, or grey)	Extensive necrosis
Incidence	11–57%	11–88%	7–26%	13.6–28%	0.5–12%	0–1%
Risk of stricture formation	0%	0%	‹5%	71.4%	~100%	

Pathophysiology

Some hypothesized theories about injury mechanisms in button battery ingestion include pressure necrosis, electrolysis by acid generating hydroxide at the battery's negative pole, caustic exposure from battery leakage, and heavy metal toxicity.[14] The study by Jetana et al concludes that button batteries can cause an isothermic hydrolysis reaction, resulting in an alkaline caustic injury. This goes along with the animal study by Yashikawa et al, the study using a cadaveric piglet model, showed that button batteries all caused significant injury at 2 hours, with substantial burns of the oesophageal mucosa, and progressed over 6 hours. This study also found no evidence of metallic elements in the solution tested. This then disproves the theory about heavy metal exposure as a possible cause.[15]

The severity of injury depends on the tissue concentration of the caustic substance. Alkaline agents can break down proteins and fats, destroy the cell wall, or cause liquefactive necrosis. Higher surface tension of alkalis can increase focal tissue concentration. Tissue destruction can continue from the mucosa through the muscle wall layers until the alkali is neutralised. In addition, thrombosis in blood vessels reduces perfusion to the burnt tissue. Inflammation and necrosis may progress due to the expansion of the ischaemic zone around the burnt tissue. Liquid injuries may be more anatomically extensive, whereas solid or particulate agents cause more focal injuries that may penetrate much more deeply into tissue due to prolonged contact time.[12]

Significant tissue damage can be shown within seconds of ingesting potent corrosive agents. Haemorrhage, thrombosis, and inflammation with oedema are the dominant processes during the first 24 hours following ingestion. Severe burns can progress to focal areas of necrosis with perforation as inflammation extends through muscle layers with submucosal thrombosis and bacterial invasion. On pathological examination, transmural necrosis shows specific criteria of coagulation necrosis (preservation of the general tissue architecture, preservation of the basic outline of the coagulated cells, presence of marked cytoplasmic eosinophilia) and nonspecific criteria of advanced necrosis (disruption of oesophageal wall architecture, karyolysis, presence of anucleate cells, necrotic debris, and leucocytic infiltrates). Fibroblast colonisation, mucosal sloughing, and granulation tissue appear at the end of the first week; oesophageal repair begins 10–15 days after ingestion.[16]

Four to seven days after ingestion, mucosal sloughing and bacterial invasion become evident. During this time, perforation can become a full-thickness injury. Esophageal repair usually starts at the tenth day after the injury. It is recommended to avoid endoscopy between 5 and 15 days after injury to reduce tensile strength. Scar retraction

begins by the third week through fibroblast proliferation. Reepithelialization of the mucosal surface begins during this period and is usually completed by the sixth week after injury. The scar formation process may develop strictures and shorten the esophagus if a large proportion of the diameter is involved. Oesophageal dysmotility due to scarring can be associated with gastro-oesophageal reflux, which can in turn accelerate scarring.[12,16]

Diagnosis

Foreign body ingestion has a wide range of symptoms. In most cases, gastrointestinal, respiratory, and nonspecific symptoms can be shown to achieve a diagnosis. Gastrointestinal symptoms like vomiting, dysphagia, odynophagia, increased salivation, changes in the daily diet resulting from loss of appetite or hematemesis may be shown in very rare cases originating from a life-threatening aorto-esophageal fistula. Respiratory symptoms may present, such as wheezing, stridor, or a feeling of suffocation.[9] It is important to take medical history regarding previous episodes of other ingestion of foreign bodies, including timing and onset of symptoms, which is usually reliable.[14]

Recognizing button battery (BB) ingestion is very important because of the narrow 2-hour golden time to remove BB impacted in the esophagus. Non figuratively, most complications occur after unwitnessed ingestions, leading to delayed diagnosis, as symptoms are variable and nonspecific.[4]

Physical examination in cases of ingestion of a foreign body in the esophagus usually does not show any abnormalities. In emergencies with compromised vital signs, an ABC resuscitation must be applied before any other intervention. In stable patients, a detailed medical history should be taken (circumstances and onset of ingestion, onset of symptoms, type and size of FB, pre-existing gastrointestinal medical conditions, and timing of last meal).[17]

Simple radiography is the first choice. A two-view (anterior-posterior and lateral) X-ray is helpful in diagnosing BB ingestion and confirming the location. The X-ray must include the entire neck, chest, and abdomen to avoid missing the battery. Close inspection of the image is necessary to identify a double ring or halo sign. Contrast studies with CT scanning (or MRI scanning after battery removal) are necessary to identify complications, such as mediastinitis, fistulas, and spondylodiscitis. Therefore, if patients have severe symptoms (at presentation or later on) indicative of possible complications (hemorrhage, hemodynamic problems, fever, respiratory symptoms, severe back pain), in case of mucosal injury identified during endoscopy, it is advised to perform (serial) CT/MRI scans of the chest and neck.[4]

Management

There are various ways to remove a foreign body in the esophagus, they are non-endoscopic methods and endoscopic methods. There are two endoscopic methods, including flexible endoscopy and rigid endoscopy. The gold standard for the treatment of foreign bodies is rigid endoscopy. Flexible endoscopy is most commonly used for diagnosis and treatment with a lower risk of complications. Flexible endoscopy is the therapeutic method of choice in treating both true gastrointestinal foreign bodies and food boluses. Clinician choice based on the patient condition, the characteristics of the object, the location, type, form, size of material, object or food that got ingested, the anatomical portion of the esophagus that was affected, and the period of the foreign body episode.[18,19]

Esophageal foreign bodies, in most cases, require endoscopic removal. Proximal esophageal blunt foreign bodies causing near-complete obstruction and/or respiratory symptoms should be managed emergently due to the higher risk of adverse events, such as aspiration. The timing of endoscopy depends on the patient's clinical status, the type (blunt or sharp-pointed) and location of the object, as well as the time of the last meal. Esophageal disk batteries and sharp-pointed objects are the most dangerous and require emergency removal.[17]

A button battery lodged in the esophagus may cause serious injuries within 2 hours; an extremely rapid referral to the emergency department (ED) is a must. In the ED, bleeding symptoms, signs, and hemodynamic status must be rapidly evaluated. Both AP and lateral X-Rays must be taken immediately to know the location of the battery and determine the negative pole orientation (smaller diameter side), thus usually causing more severe lesions.[17]

The treatment approach for the removal of batteries in the esophagus is endoscopy and

retrieval with magnetic probes under fluoroscopy guidance, whereas the Foley catheter and bougie dilation techniques are appropriate for coins and other regular-shaped objects and for cases with no respiratory problems and who have not previously undergone esophagus surgery. After the surgery, a nasogastric tube (NGT) will be inserted to prevent further injuries to the esophagus from the esophagus' peristaltic movements during swallowing food and to evaluate for excessive bleeding.[9]

In asymptomatic patients, batteries that are located in the stomach or beyond should be monitored with repeat radiographs unless an accompanying magnet is swallowed. Post-removal endoscopic and radiology follow-up is important to monitor possible delayed complications.[9,17]

Complications

It is important to predict, promptly detect, and treat potential severe complications associated with battery ingestions. The complications include esophageal stenosis or perforation, mediastinitis, tracheoesophageal fistula, vocal cord paresis and paralysis, spondylodiscitis, intestinal perforation with peritonitis, cardiovascular and respiratory failure, pneumothorax, pneumoperitoneum, anterior spinal artery syndrome with bilateral lower extremity paralysis, vascular fistula leading to hemorrhage, and death.[20]

In battery ingestion cases, it is essential to recognize the spectrum of esophageal and para-esophageal complications that may occur in children, as well as the specific management challenges these cases present. The risk of delayed complications, such as aortoenteric fistula (AEF), which can occur days or even weeks after button battery removal, further complicates clinical decision-making, particularly regarding patient disposition and post-removal monitoring[14]

Another complication of ingestion in children is corrosive esophagitis, also known as caustic esophagitis. The incidence of corrosive esophagitis continues to rise in developing countries, primarily due to a lack of preventive measures. This condition is commonly caused by the ingestion of various chemicals, both alkaline and acidic substances, with alkaline agents being more frequently involved. Button batteries, which contain alkaline materials, are among the common foreign bodies ingested by children and can lead to severe esophageal injury.[21]

Endoscopic grading of corrosive esophagitis, using Zargar endoscopic classification, can determine prognosis. The grade of injury is an important predictor of strictures. Endoscopic grades 1, 2 (2A) are considered "low-grade" injuries, while injuries grades 2B, 3, and 4 are recognized as "high-grade" injuries. Chronic complications are not usually seen in cases of grade 1 and 2 injuries. The majority of grade 1 and 2A patients can fully recover. In contrast, most of the patients with grade 3 corrosive esophagitis are likely to develop strictures.[2]

Case Report

A case was reported of a 4-year-old girl who presented to the Emergency Department of Dr. M. Djamil Hospital on December 8th, 2022, with a chief complaint of feeling as though something was stuck in her throat for three days prior to admission. The incident began while the patient was playing alone; she later told her parents that she had swallowed a button battery. She was initially taken to a hospital in Wamena, Papua, where surgical removal of the foreign body was planned. However, due to limited medical facilities, the patient was referred to Wahidin Soedirohusodo Hospital in Makassar, South Sulawesi. The parents declined this referral and instead requested a transfer to Dr. M. Djamil Hospital in Padang. Upon arrival, the patient reported no pain or difficulty in swallowing. There was no blood-tinged saliva, drooling, neck pain, or restricted neck movement. She also had no difficulty opening her mouth, no hoarseness, and no signs of respiratory distress such as dyspnea, chest pain, choking, coughing, or cyanosis. There had been no attempts to remove the button battery prior to admission.

On physical examination, the patient appeared to be in good general condition, with a pulse rate of 108 beats per minute, a respiratory rate of 25 breaths per minute, a body temperature of 37.3°C, and a body weight of 13 kg.

Thoracic examination showed symmetrical chest movements, with no signs of retraction, abnormal breath sounds, stridor, or wheezing. Examination of the ears and nose was within normal limits. Intraoral examination revealed no trismus. Throat examination demonstrated symmetrical pharyngeal arches, a midline uvula, tonsils graded T1–T1 without signs of hyperemia,

and a posterior pharyngeal wall that appeared normal without hyperemia.

A chest X-ray taken on December 8th, 2022, revealed the presence of a round radiopaque foreign body located in the esophagus at the level of the second thoracic vertebra (T2), consistent with the appearance of an ingested button battery. (**Figure 1**).

Figure 1. Chest X-ray showing a button battery at the T2 vertebral level

The patient was diagnosed with a foreign body in the esophagus, suspected to be a button battery. A diagnostic and therapeutic esophagoscopy under general anesthesia was planned. The parents were informed about the procedure, including potential risks, and provided their consent.

Laboratory tests performed on December 8th, 2022, showed hemoglobin 12.4 g/dL, leukocytes 17,530/mm^3, hematocrit 36%, and platelets 574,000/mm^3. The results indicated leukocytosis. A chest X-ray confirmed the presence of a foreign body with radiopaque characteristics consistent with a button battery.

The case was consulted with the Pediatric Department, which confirmed the working diagnosis of a button battery foreign body in the esophagus. No contraindications were found for surgical intervention. The patient was recommended to receive maintenance IV fluids (KaEn 1B at 16 drops/minute, macrodrip) and prophylactic antibiotics (ceftriaxone 850 mg IV twice daily). A preoperative assessment by the Anesthesiology Department also cleared the patient for esophagoscopy under general anesthesia.

On December 8th, 2022, a diagnostic and therapeutic rigid esophagoscopy was performed under general anesthesia with the patient in the supine position. After aseptic and antiseptic preparation, a rigid esophagoscope (10 x 14 x 30 cm) was introduced. The esophagoscope was held in the left hand, similar to holding a pencil, while the middle and ring fingers were used to retract the upper lip and hook the upper incisors. The right hand's thumb and index finger supported the distal portion of the scope. The scope was inserted vertically through the right side of the oral cavity, with the patient's head in a flexed position.

The esophagoscope was advanced until the uvula and posterior pharyngeal wall were visible. The tip of the scope was gently directed into the esophageal introitus. At 13 cm from the incisors, necrotic tissue was noted. A round foreign body, consistent with a button battery, was found at 15 cm from the incisors and was removed using alligator forceps.

Further inspection of the esophageal lumen was performed by re-inserting the esophagoscope to a depth of 20 cm from the incisors. Additional necrotic tissue and mucosal excoriation were observed at 18 cm, but no active bleeding was noted. The esophagoscope was then withdrawn, and a nasogastric tube (NGT) was inserted. The procedure was completed without immediate complications.

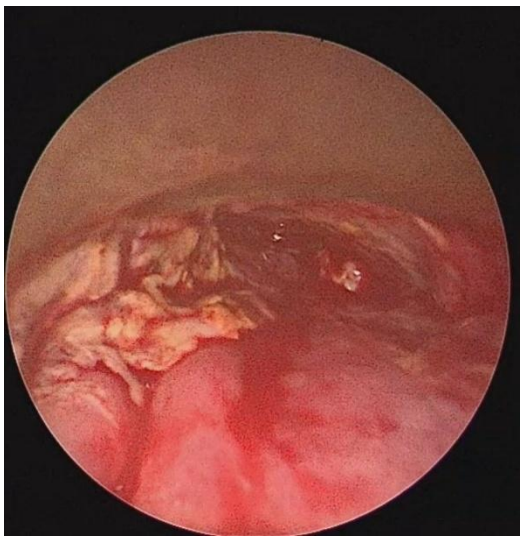

Figure 2. Overview of esophageal lumen after extraction

The patient was diagnosed after a post-esophagoscopy diagnostic and therapeutic procedure, caused by a foreign body, a button battery, in the esophagus. Patient was given therapy IVFD KaEn 1B 16 gtt, ceftriaxone injection 2x850 mg, dexamethasone injection 3x2mg, ranitidine injection 2x13mg, and paracetamol syrup 3x7.5 ml per oral. Post-operation

instructions were to monitor vital signs, esophagus perforation, and liquid food diets from the NGT.

On the day after surgery, December 9th, 2022, the patient experienced pain during swallowing, but there was no bloody saliva, chest pain, difficulty breathing, fever, or coughing. Physical examination of the throat revealed symmetrical pharyngeal arches, a midline uvula, tonsils graded T1–T1 without hyperemia, and a non-hyperemic posterior pharyngeal wall. No active bleeding was observed. The patient received intravenous fluid therapy (KaEn 1B at 16 drops/min), ceftriaxone injection 850 mg twice daily, dexamethasone injection 2 mg three times daily, ranitidine injection 13 mg twice daily, and oral paracetamol syrup 7.5 mL three times daily.

On December 10th, 2022, the patient removed the nasogastric tube (NGT) on her own. Although reinsertion of the NGT was planned, the parents refused further treatment. The patient was then prescribed oral medications, including cefixime 100 mg syrup (¾ spoon twice daily), paracetamol 120 mg syrup (1½ spoons three times daily), and antacid syrup (½ spoon three times daily).

One week after the esophagoscopy, the patient did not return for follow-up at the ENT outpatient clinic at Dr. M. Djamil Hospital. Follow-up was conducted by phone with the parents, who reported that the child had no pain or difficulty swallowing, no breathing difficulties, and no fever.

A subsequent phone follow-up with the parents on May 29th, 2023, confirmed that the patient had not experienced any symptoms or signs of complications.

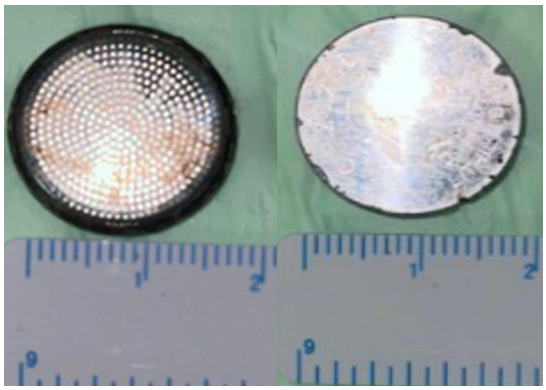

Figure 3. Extracted button battery

Discussion

We report the case of a 4-year-old girl diagnosed with a button battery foreign body in the esophagus, treated with diagnostic and therapeutic esophagoscopy under general anesthesia. Foreign body ingestion is common in children, particularly between six months and six years of age. Button battery ingestion occurs at a rate of 9.8 per million annually, with 67% of cases involving children under six.[17,22]

The most frequent sites of foreign body impaction are the stomach (60%), esophagus (20%), oropharynx (5–10%), and small intestine (10%). The upper esophagus is the most common site requiring endoscopic intervention due to its narrow anatomy.[23]

In this case, the patient presented with the sensation of something stuck in the throat after accidentally ingesting a battery while playing, but without pain or swallowing difficulty. Clinical symptoms of esophageal foreign bodies can vary, including hypersalivation, vomiting, dysphagia, odynophagia, chest pain, or may be absent. In one study, drooling (60%) and vomiting (51%) were the most common symptoms, while 9% of patients were asymptomatic.[25]

This patient experienced delayed diagnosis due to inter-hospital referrals and the family's choice of treatment facility, with three days passing before admission. Fortunately, emergency surgery was successfully performed on the day of admission.

Shivakumar et al[24] conclude that diagnosis of foreign body ingestion is based on three important elements: history of ingestion of a foreign body, x-ray, and upper GI endoscopy. Several studies have shown that radiography is a useful tool in the diagnosis of foreign body ingestions. An initial radiographic assessment is usually the preferred initial step in foreign body management. Radiographs can confirm the size, location, shape, and number of ingested foreign bodies.[25]

If the patient is unable to provide a history and radiographic studies are inconclusive or negative, additional diagnostic modalities may be necessary. Contrast-enhanced CT scans or MRI scans after battery removal are important tools to identify potential complications such as mediastinitis, fistulas, or spondylodiscitis.

Therefore, in cases where the patient presents with severe symptoms either at initial presentation or later, such as hemorrhage, hemodynamic instability, fever, respiratory distress, or severe back pain, and especially when mucosal injury is identified during endoscopy, it is recommended to perform serial CT or MRI scans of the chest and neck. In cases of delayed diagnosis of esophageal button battery impaction, which is defined as

radiographic confirmation more than 12 hours after ingestion or battery removal performed more than 12 hours after ingestion, CT or MRI imaging should also be considered, regardless of the presence of symptoms, since significant esophageal injury may have already occurred.[4]

Assessment of the patient's airway is the first step in the initial evaluation. Patients who have increased secretions are at an increased risk and require urgent management. For patients with proximal foreign bodies, patients who have ingested multiple objects, and patients with difficulty in removing foreign bodies, the use of endotracheal intubation is necessary and beneficial. The use of an overtube should also be considered to prevent an object from accidentally being dropped into the patient's airway. A laryngoscope should be immediately available in the event of airway obstruction.[13,26]

In these cases, the foreign body was removed more than 2 hours after the patient accidentally swallowed the battery three days before admission, and then an X-ray was performed. Button battery ingestion for more than 2 hours may cause serious injuries; thus, an extremely rapid referral to the emergency department is mandatory.[17]

Several theories have been hypothesized regarding the mechanism of injury in battery ingestions. Local pressure necrosis, corrosive damage from leakage of battery contents, heavy metal toxicity, and electric injury all seem to play a role. In case a battery contacts the esophageal tissue, a current is created, with human tissue acting as the connector of the circuit between the two battery poles. This leads to hydroxide ion formation at the negative pole, which in turn rapidly leads to a rise in pH, causing tissue liquefaction and necrosis, comparable to the damage occurring in the esophagus after alkaline liquid ingestion (10–12). Transmural esophageal wall damage may occur, leading to fistulization of both the esophageal wall and surrounding tissues (such as the trachea, aorta, or subclavian artery), resulting in several life-threatening complications.[4]

Reported complications include esophageal stenosis or perforation, mediastinitis, tracheoesophageal fistula, vocal cord paresis and paralysis, spondylodiscitis, intestinal perforation with peritonitis, cardiovascular and respiratory failure, pneumoperitoneum, anterior spinal artery syndrome with bilateral lower extremity paralysis, vascular fistula leading to hemorrhage, and death. Importantly, complications often present in a delayed fashion, with bleeding events reported weeks after button battery removal.[20,26]

Other complications, such as esophageal stricture and perforation, spondylodiscitis, and tracheoesophageal fistula, have been reported to present weeks to months later, with some cases occurring as late as 6 to 8 months following button battery ingestion. In a recent retrospective review of 189 patients, 2% developed acute esophageal perforation.[20]

The patient was treated with esophagoscopy, which was both diagnostic and therapeutic. Rigid and flexible endoscopes are regarded as interventions for removing foreign bodies. If a foreign body is located below the cricopharyngeus, either rigid or flexible endoscopy can be performed. Flexible endoscopes are effective because the procedure can be done in the outpatient clinic without general anesthesia, but if the foreign body is sharp or embedded, rigid endoscopy is necessary.[27]

According to the latest guidelines from the American Society for Gastrointestinal Endoscopy (ASGE) and the European Society of Gastrointestinal Endoscopy (ESGE), emergent endoscopy is recommended for impacted sharp objects within 24 hours after ingestion to reduce the risk of devastating complications.[27]

In symptomatic patients with a battery in the stomach, emergent endoscopic removal with evaluation of esophageal and gastric lesions should be performed. In asymptomatic patients, removal within 24 hours is considered reasonable, except in cases of concomitant magnet ingestion, multiple batteries, or young children (**Figure 4**).[17]

If the foreign body is not extracted or is not successfully removed, there is a 14-fold increased risk of mucosal damage in the esophagus due to pressure from the foreign body on the esophageal lining. It has been reported that 49% of patients with foreign body ingestion had minor or superficial abrasions of the esophageal mucosa, and 2% had erosion with necrotic debris. Retained foreign bodies in the esophagus can cause necrosis due to pressure, which may lead to perforation. Furthermore, esophageal foreign bodies may penetrate and migrate into the extraluminal space. Failed treatment can result in serious complications from esophageal foreign bodies.

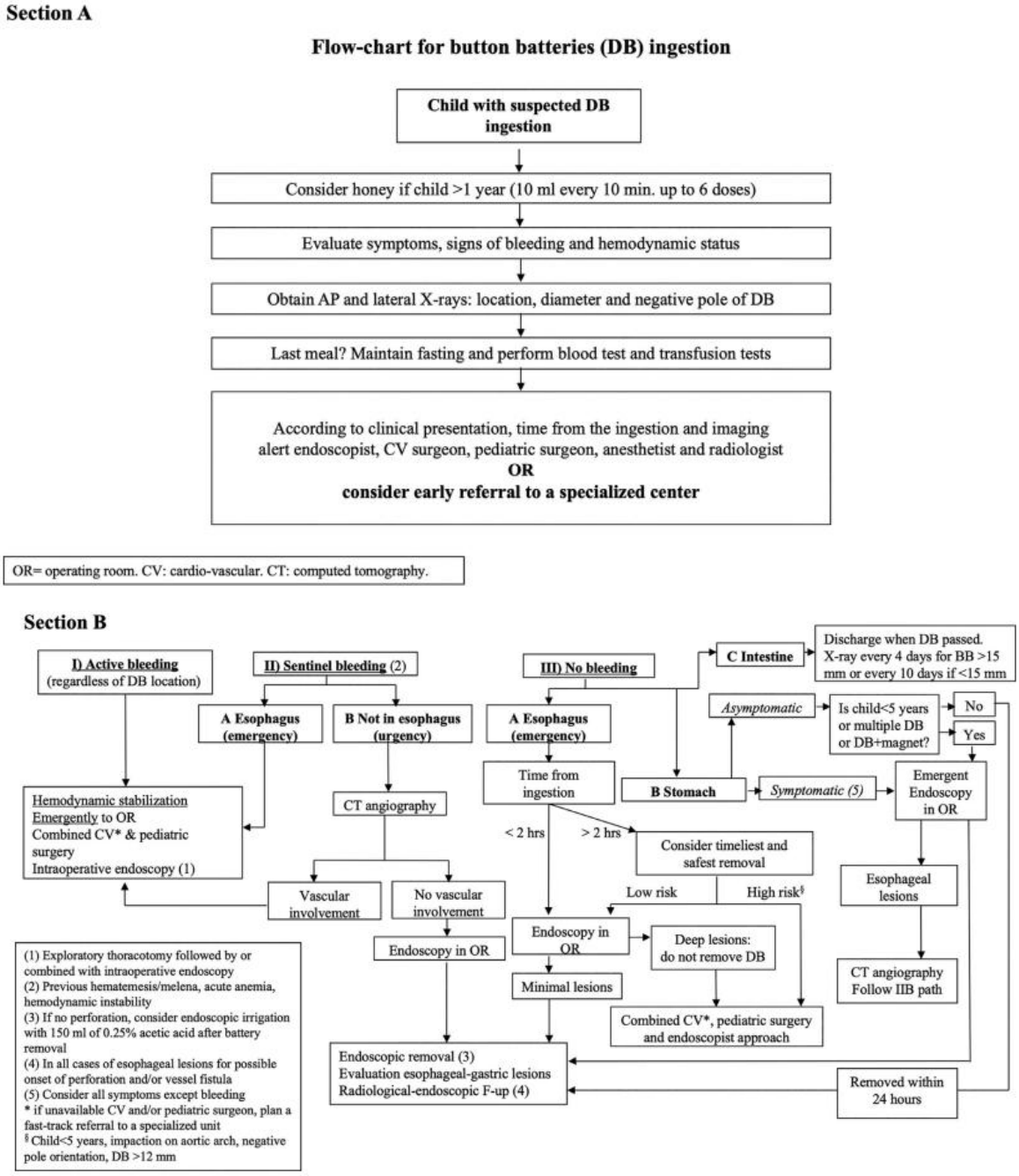

Figure 4. Algorithm of Battery Foreign Body in Children Management[17]

Conclusions

If a button battery foreign body is swallowed, it should be suspected that the foreign body is in the esophagus and should be extracted immediately. Esophagoscopy remains the mainstay of treatment for foreign bodies in the esophagus. Inserting a nasogastric tube (NGT) after surgery is recommended to avoid severe complications. The implementation of NGT placement is additionally advantageous for enhancing the healing process while mitigating the severity of necrotic tissue and excoriation during surgical procedures, as well as facilitating nutritional support throughout the therapeutic regimen. Parents should be educated about the potential hazards of button batteries. Devices that use such batteries should be kept out of reach of small children.

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