



Ingestion of Foreign Body (Button Battery): 3 Years Experience at Tertiary Care Hospital

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Abstract

Objective: Button batteries (BB) in the aerodigestive tract are a common cause of morbidity and mortality in infants and children worldwide. After the nose and ear, the esophagus is the most common site of foreign body impaction. The purpose of this study is to study the different presentations of button battery as a foreign body and present our experience in the diagnosis and management of this hazardous problem in children.

Methods: This study included 50 patients. The diagnostic protocol comprised of a detail history taking, physical examination of head and neck, and appropriate radiographic evaluation. The button batteries were emergently extracted under general anesthesia.

Results: The average follow-up period was 2.5 months. Thirty-five patients had an esophageal button battery. Six patients had button battery in the tracheobronchial area. Nine patients had a button battery in the stomach and below. One patient developed tracheoesophageal fistula, and one patient expired of aorto-esophageal fistula.

Conclusion: Early detection is the key to the management of button battery as foreign bodies. They have a distinctive radiological appearance, and its prompt removal is mandatory, especially for batteries lodged in the aerodigestive tract. Physicians must recognize the hazardous potential and serious implications of such an accident. There is also a definite need for more public education and awareness about this serious problem.

Keywords: aerodigestive tract, button battery, oesophagoscopy.

Introduction

The swallowing of button batteries (BB) into the aero digestive tract is a widespread problem and is a common cause of morbidity and mortality in infants and children worldwide. After the nose and the ear; the esophagus is the most frequent

site of foreign body impaction. About 70-80% of these batteries are held up at the cricopharynx^[1]. Despite public awareness and improvements in medical care, the worldwide annual incidence of deaths from foreign body aspiration is estimated to be between 500 and 2000. There are over 3000

ingestions of button batteries per year, placing children at a risk of serious injury and even death^[1]. Nowadays, button batteries are used widely in devices such as hearing aids, electronic games, watches, digital planners, and new electronic gadgets. They are often small, disc- or button-shaped, and the shiny appearance of these button batteries attracts the children as they handle these batteries eagerly whenever the opportunity arises^[1]. Although these batteries are often sealed, they are known to contain toxic and corrosive chemicals, including heavy metals such as mercury, nickel, silver, cadmium, zinc, manganese, and lithium; in addition to concentrated alkaline electrolyte solutions of sodium or potassium hydroxide^[2]. These electrolytes may leak out particularly when kept in contact with the moist surfaces of the mouth, trachea, or esophagus. The acid contained in the stomach may also serve to increase the risk of leakage of the contents of the battery when swallowed^[3].

It has been estimated that 80% of all cases of swallowed foreign bodies occur in children who are mainly between the ages of six months to three years^[4-7]. Most often, the button batteries pass through the gastrointestinal tract without causing any complication, but sometimes, it can cause severe problems depending upon the duration to seek medical attention and the level of obstruction. When lodged in esophagus it can cause odynophagia, drooling, spitting, and vomiting. These symptoms which are suggestive of foreign body ingestion occur as often as up to ten cases out of every million people every year^[6]. Button battery foreign bodies can have a fatal outcome^[8, 9]. However, in the vast majority of cases, they result in little to no ill effect on the child^[10]. When lodged in the respiratory tract, they may cause shortness of breath, wheezing, stridor, cough, recurrent or migratory pneumonia, and acute aphonia. The outcome of button batteries in the aero digestive tract depends on several factors, including the location, duration of mucosal or skin contact, remaining voltage in the

battery, and chemical composition of the battery^[1].

The purpose of this work is to study the different presentations of button battery foreign bodies and present our experience in the diagnosis and management of this hazardous problem in children.

Materials and Methods

Between January 2014 and December 2016, 50 cases of BB ingestion & inhalation presented to the Department of Neonatal & Paediatric Surgery, Children Hospital, PIMS, Islamabad, Pakistan, and were reviewed prospectively. All the children were between 6 months to 12 years of age who presented to pediatric surgery department were included in this study. The diagnosis was based on the history, clinical examination, and results of imaging studies. The clinical data reviewed included gender, age, clinical manifestation, imaging and endoscopic findings.

All patients underwent X-rays of the soft tissue of the neck and upper chest in anteroposterior (AP) and lateral (L) views for determining the location of the BB. Abdominal X-ray was performed in patients with no radiological evidence of BB in the neck and chest. A fully informed written consent was obtained from the parents and/or guardians of all the patients. We used rigid esophagoscopy and Magill's forceps for esophageal BB; and rigid bronchoscopy for BB in the respiratory tract.

Results

Among the 50 patients, button batteries in the digestive passage were found in 44 (88%) patients, and in the airway of 6 (12%) patients. A male predominance was observed in both foreign body ingestion and foreign body inhalation, that is 31 (62%), and 19 (38%) cases respectively (Table 1).

Table 1: Gender distribution of the cases

S. No.	Gender	Digestive tract		Airway	
		Frequency	Percentage	Frequency	Percentage
1.	Male	27	61.4	4	66.7
2.	Female	17	38.6	2	33.3

Most patients (24 cases; 54.5%), who had BB ingestion, belonged to the 6 months to 3 years age group. The total age range of all the patients was

between 6 months to 12 years. Most cases (3 cases; 50%) of BB ingestion also belonged to the 6 months to 3 years age group (Table 2).

Table 2: Age distribution of the cases.

S. No.	Age	Digestive tract		Airway	
		Frequency	Percentage	Frequency	Percentage
1.	6mo – 3yrs	24	54.54	3	50
2.	3 – 5yrs	12	27.27	2	33.33
3.	5 – 12yrs	8	18.18	1	16.66

The time of presentation in patients with BB in digestive tract varied from between 1 hour and one-week post-ingestion. In 17 (38.6 %) cases, the diagnosis was formulated within first 6 hours after the ingestion, and in 24 (54.5 %) cases with a delay greater than 6 hours but less than 24 hours. It was only in 3 (6.8 %) cases that the BB was detected more than 24 hours post-ingestion. Duration of BB lodgment in airway ranged between 1 hour and 24 hours. Four (66.7%) cases reported within first 6 hours, 2 (33.3%) cases within 6 to 24 hours and no evidence of BB was observed after 24 hours. The most common site of lodgment of BB is in the digestive tract are seen at

the cricopharynx in 24 (54.5 %) cases, hypopharynx in 11 (25.0%) cases, and the stomach or below in 9 (20.5 %) cases (Table 4).

In patients with BB in their digestive tracts, the most common symptoms were dysphagia in 32 cases (72.7 %), foreign body sensation in 26 cases (59.1 %), odynophagia in 13 cases (29.5 %), and vomiting in 11 cases (25.0%). With button battery in the tracheobronchial passages, the most common sign and symptoms were rhonchi, and additional attenuated sounds in 2 (33.3 %) cases, and dyspnea in 3 (50.0 %) cases respectively. Other signs were decreased air entry in 1 (16.67 %) case and hyper-resonance in 1 (16.67 %) case.

Table 3: Distribution of cases by site of lodgment

S. No.	Digestive tract			Airway		
	Site	Number	Percentage	Site	Number	Percentage
1.	Cricopharynx	24	54.5	Trachea	2	33.3
2.	Hypopharynx	11	25.0	Right bronchus	3	50.0
3.	Stomach & below	9	20.5	Left bronchus	1	16.7

The most common site of lodgment of BBs in the airway tract was the bronchus in 4 cases (66.67 %), particularly in the right bronchus in three out of the four cases. Other sites were the trachea in 2 (33.3%) cases and the left bronchus in 1 (16.7%) cases. No button battery was detected in the larynx.

The management strategy in all 9 patients with BB in their stomachs & below was conservative

while for BB in the hypopharynx and cricopharynx, the management strategy was direct laryngoscopy and rigid esophagoscopy with forceps removal.

Of all the 44 patients with BB ingestion, one patient developed tracheoesophageal fistula, and another patient expired as a result of aorto-esophageal fistula.

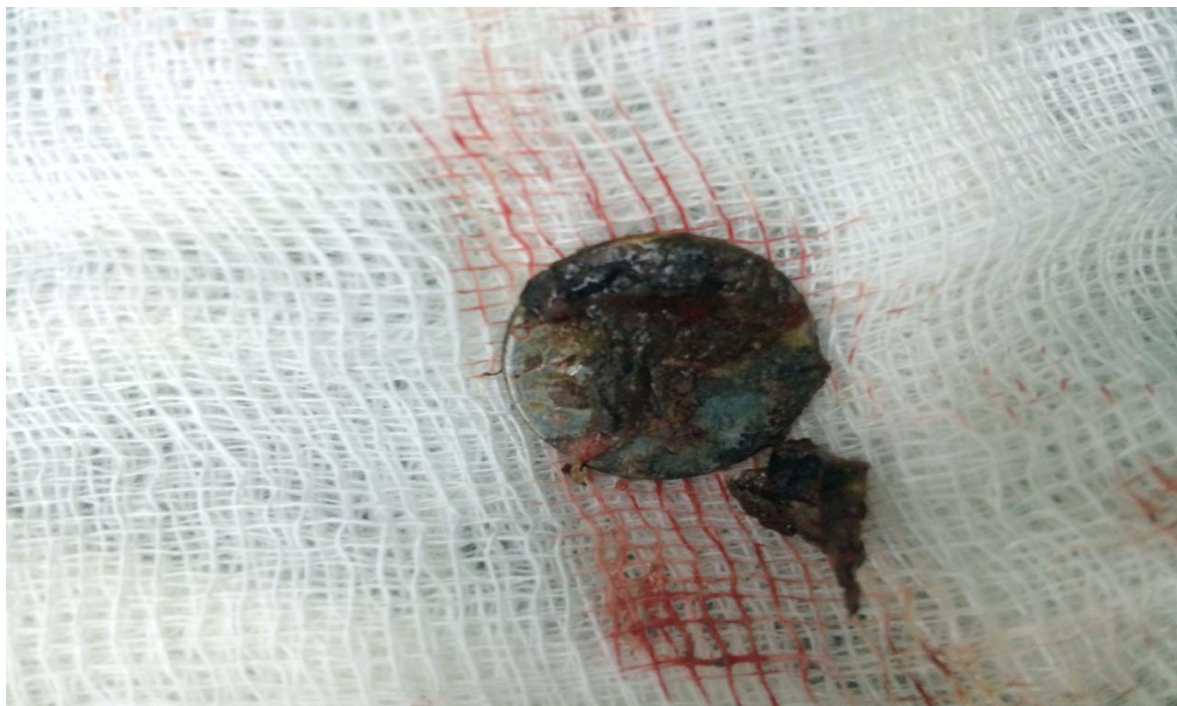


Figure 1: An extracted button battery from the esophagus (20 mm).

Discussion

Button batteries (BB) are common causes of morbidity and mortality in infants and children worldwide. It is difficult to eradicate the problem, as children, by nature, are curious and exploratory. They form the third leading cause of death in children under the age of 1 year, and the fourth leading cause in the age group 1–6 years^[1, 7, 12]. The high prevalence is observed between the ages of 1 and 2 years; however, no age group is entirely immune^[1,4,13]. Children younger than 5 years of age represent the highest risk group. Button batteries are increasing in the use in recent years as technology advances. They are used in various electronic devices like toys, hearing aids, electronic games, watches, digital planners, and new electronic gadgets such as remotes and other electronic devices that are increasingly used in day to day life^[11, 12]. Batteries account for less than 2% of the foreign bodies ingested in children^[13–15]. It has been estimated that 80% of all cases of swallowed foreign bodies occur in children, mainly between six months and three years of age^[4–7]. In our study, 54.54% of BB ingestions occurred within the same age group. Moreover, in this study, 50% of BB ingestion into the

tracheobronchial area belonged to the same age group, that is 6 months to 3 years.

Based on chemical composition, five types of batteries are in common use: manganese, silver, mercury, lithium, and zinc^[15]. The vast majority of button batteries today are of the alkaline variety, with respect to the composition of the electrolyte within the battery^[16]. Four mechanisms of injury have been suggested: first, through leakage of the battery's contents and direct corrosive damage; second, through direct electrical current effects on the mucosa and resultant mucosal burns; third, through pressure necrosis resulting from prolonged local pressure on surrounding tissues; and fourth, through local toxic effects due to the absorption of substances^[17–21]. Within normal circumstances, spontaneous leakage of the electrolyte content does not occur except the batteries come in contact with moisture, which the mucosa and other tissues provide. Once the electrolyte leaks, it gradually degrades the tissues, causing liquefying necrosis. This effect has been described as a dissolution of collagen and other proteins, saponification of lipids, dehydration of cells, and a resulting extensive damage to tissues^[22]. In terms of size,

most of the batteries swallowed are large ones, usually about 20 mm or more in diameter. These large batteries are difficult to pass through esophagus smoothly, especially in younger children. This increases the chance of obstruction significantly.

In a large proportion of patients, swallowed batteries remain in the upper portion most of the time because of anatomical strictures such as the cricopharyngeus sling, aortic arc, and the initial portion of left bronchus. This probably accounted for the 24 cases (54.54%) of BB ingestion that got stuck in the esophagus at the level of the cricopharyngeus. Also, the time of presentation is very important factor in determining the outcome of BB ingestion/inhalation as delay can cause serious complications. The rapidity of the development of complications can be as short as a few hours, as in this study, 17 cases (38.63%) of BB ingestion and 4 cases (66.67%) of BB inhalation presented within the first six hours. One patient who developed tracheoesophageal fistula had presented after 24 hours of BB ingestion and later underwent surgical intervention in which the fistula was repaired and recovery was uneventful. Similarly, another patient who presented after 24 hours of BB ingestion developed aorto-esophageal fistula was expired. It is clear that the longer the delay in presentation or initiation of treatment, the higher the chances of developing significant complications. As seen in Table 3, the most common signs and symptoms of BB ingestion were dysphagia (72.7%), and foreign body sensation (59.1%). On the other hand, the most common signs and symptoms of BB inhalation were dyspnea (50.0%), and rhonchi (33.3%).

The management of BB in the aerodigestive tract requires prompt diagnosis. After careful history and physical examination, x-rays of the neck and chest in anteroposterior and lateral views should be obtained. Button battery has a characteristic halo sign or double ring appearance on radiographic image^[1]. Once the diagnosis is confirmed, it should be removed as soon as

possible because of the high risk of complications. In our study, batteries at the level of the cricopharyngeus were removed by Magill's forceps, and in hypopharyngeus by rigid esophagoscopy. Cases in which the battery had passed beyond the stomach were managed conservatively, and within 2 days, all were passed out in the stool uneventful. Button batteries in the tracheobronchial area were removed by rigid bronchoscopy without any complications. The long-term follow-up of our patients showed no early or late complications.

Endoscopic removal and a close follow-up by a multi-disciplinary group of physicians are essential to deal with both early and late complications. Finally, prevention is the best management of all. It is crucial that parents and caretakers be aware of the potential danger of button battery ingestion and the importance of providing immediate care. Security of devices containing button batteries should be reviewed to find the way they cannot be released by children. Furthermore, product manufacturers need to redesign battery-powered household products to secure the battery compartment^[23]. Electronic and print media should be utilized to develop awareness in the community. Pamphlets should be distributed to educate the public as parental vigilance can then reduce child exposure to dangerous objects. Parents and Caregivers should also be familiar with choking-related rescue maneuvers

Conclusion

This study has provided evidence to show that the ingestion/inhalation of button batteries occurs more frequently than is previously thought and the early diagnosis and prompt treatment is of significant step to diminish the risk of potentially fatal complications. It is particularly crucial that physicians have a high index of suspicion and can recognize the potential and serious implications of such an accident. There is also a definite need for more public education and awareness about this serious problem.

Conflict of Interest

The author finds no conflict of interest.

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