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Original Article

Button Battery Ingestion: An Analysis of 40 Pediatric Patients

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Abstract

Objective: **Button battery ingestion poses a special problem in children because of its potential for significant morbidity and mortality. It may leak or burst within 24 hours of ingestion and cause corrosive alkaline burn or poisoning from heavy metal salt. The aim of this study was to evaluate clinical characteristics, management and outcomes of children with button battery ingestion over the last eight years at our institute.**

Materials and Methods: **Medical records of 40 patients who were admitted to Queen Sirikit National Institute of Child Health due to button battery ingestion from January 2004 to December 2011 were reviewed. The diagnosis of button battery ingestion was based on history, clinical symptoms, and results of radiological findings. Clinical data were reviewed including demography, clinical manifestations, imaging findings, management, and outcome.**

Results: **Of the 40 patients, male to female ratio was 1.4:1. Approximately 50% of patients were under 2 years of age (range, 8 months to 4 years). Only eight patients developed symptoms of dysphagia, vomiting or abdominal pain. Thirty cases (75%) were brought to the hospital within six hours after button battery ingestion. One patient had a battery impacted in the esophagus but spontaneously passed into the stomach. This button cell passed through the rectum three days later. Twenty three cases had button batteries lodged in the stomach on admission. Sixteen cases underwent gastroscopy with successful retrieval, whereas the remaining seven cases were conservatively treated. Button batteries were lodged at the small and large intestine in 17 patients; these passed through the rectum successfully within two days. There were no morbidity and mortality among these 40 patients.**

Conclusions: **Button battery ingestion is a common problem in children under five years of age. Batteries lodged in the esophagus should be immediately treated by endoscopic removal. Treatment of button batteries lodged in the stomach is controversial; either endoscopic removal or conservative management might be appropriate. Once the button cells are found in the intestine, they will spontaneously pass through the rectum within two days in most cases.**

Keywords: **button/disc/disk battery ingestion, endoscopic removal**

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Introduction

Button or disc or disk batteries are small, coin-shaped batteries used in toys, watches, calculators and hearing aids. They contain mercury, silver, manganese, cadmium, lithium, zinc, copper, sulfur oxide, brass and steel. These are the components of the anode and cathode of the battery. Sodium or potassium hydroxide is contained in the button batteries in order to facilitate the electrochemical reaction[1]. Over the past decade, ingestion of button batteries has been seen with increasing frequency in children. Most cases of button battery ingestion result in an uneventful course[2-4]. Button batteries lodged in the alimentary tract is potentially hazardous in some cases, especially if lodged in the esophagus[5-8]. The battery may leak or burst within 24 hours after ingestion, and may cause corrosive alkaline burn or poisoning from heavy metal salt.

Management of button batteries in the alimentary tract according to guidelines ranged from aggressive treatment such as surgery in the past, to conservative management at the present time[5,9]. We herein analyzed 40 pediatric patients with button battery ingestion treated at our institute during an 8-year period.

Materials and Methods

The medical records of 40 patients with ingestion of button batteries who were admitted to Queen Sirikit National Institute of Child Health between January 2004 and December 2011 were reviewed. The study began after the research proposal had been approved by the Institutional Review Board (Document No. 55-075). Medical records were abstracted for information on gender, age, clinical, presentations, radiological findings, hospital course and results of the treatment.

Results

Forty patients, consisting of 23 males and 17 females, with a history of button battery ingestion were admitted and treated at our institute during the study period. Their ages ranged from 8 months to 4 years and 52% of patients were under 2 years of age (Table 1). Approximately 80% of cases had no symptom after button battery ingestion. Vomiting, dysphagia and abdominal pain were noted in three, three, and two cases, respectively. The interval from ingestion to admission varied from one hour to five days. Thirty cases (75%) were brought to the hospital within six hours after ingestion. Most of the ingested button batteries (90%) were used for toys and only 10% were used for electrical devices such as calculators and watches.

Forty-three ingested button batteries were seen on radiological imaging, one battery per patient in 38, and 2 and 3 batteries in the 2 remaining patients (Figure 1 and 2). From the initial radiographs, 25 of the 43 button batteries were found in the stomach (Table 2). The remaining 18 batteries were lodged in the small and large intestine in 10 and 7 cases, respectively, and one in the esophagus. One boy ingested two button batteries; one was found in the lower esophagus and the other in the stomach (Figure 1). He was admitted by a pediatrician and a surgical consultation was made a few hours later. He was conservatively treated and the two batteries were passed from the rectum within three days.

Of the 23 patients with 25 button batteries lodged in the stomach, 16 (18 button cells) underwent gastroscopy with successful retrieval (Figure 3). Only mild erosion of the gastric mucosa was noted in five cases during gastroscopic removal of batteries. The remaining seven cases (seven button cells in the stomach) were conservatively treated, with spontaneous passage of all batteries from one to three days. The decision to endoscopically remove or conservative

Table 1 Demographic data and clinical presentation of 40 patients

Clinical data	No. (cases)	Percent (%)
Sex		
Male : female	23 : 17	58 : 42
Age (years)		
0-1	7	17.5
1-2	14	35.0
2-3	10	25.0
3-4	9	22.5
Clinical presentations		
Vomiting	3	7.5
Dysphagia	3	7.5
Abdominal pain	2	5.0
Absence of symptom	32	80
Time from ingestion to admission (hours)		
0-3	20	50.0
3-6	10	25.0
6-24	5	12.5
> 24	5	12.5

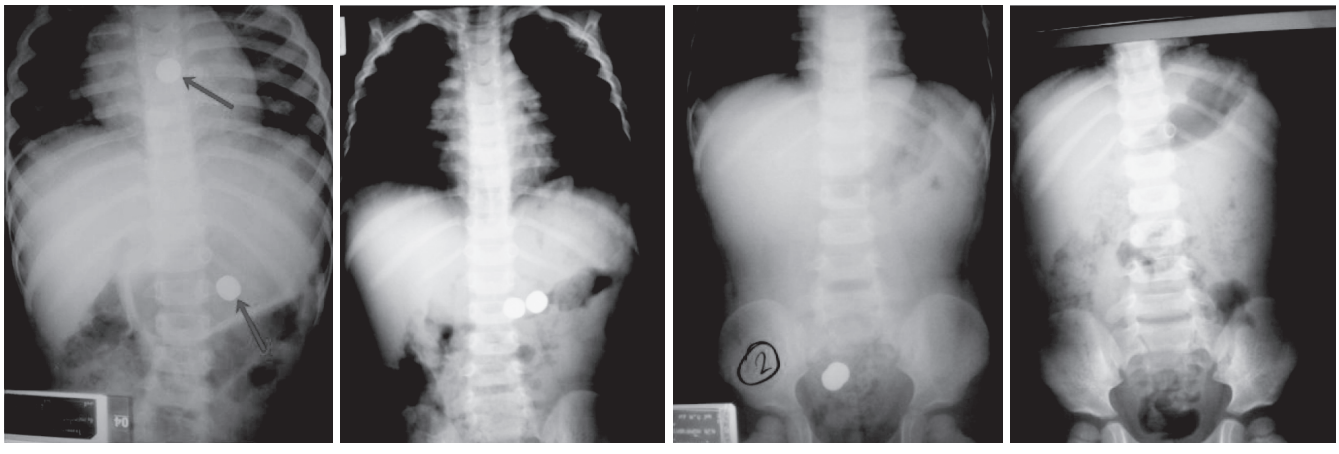


Figure 1 Two button batteries lodged at the lower esophagus and the stomach. Battery in the esophagus spontaneously passed into the stomach within a few hours. This patient was conservatively treated and the two batteries were expelled from the rectum within 48 hours.

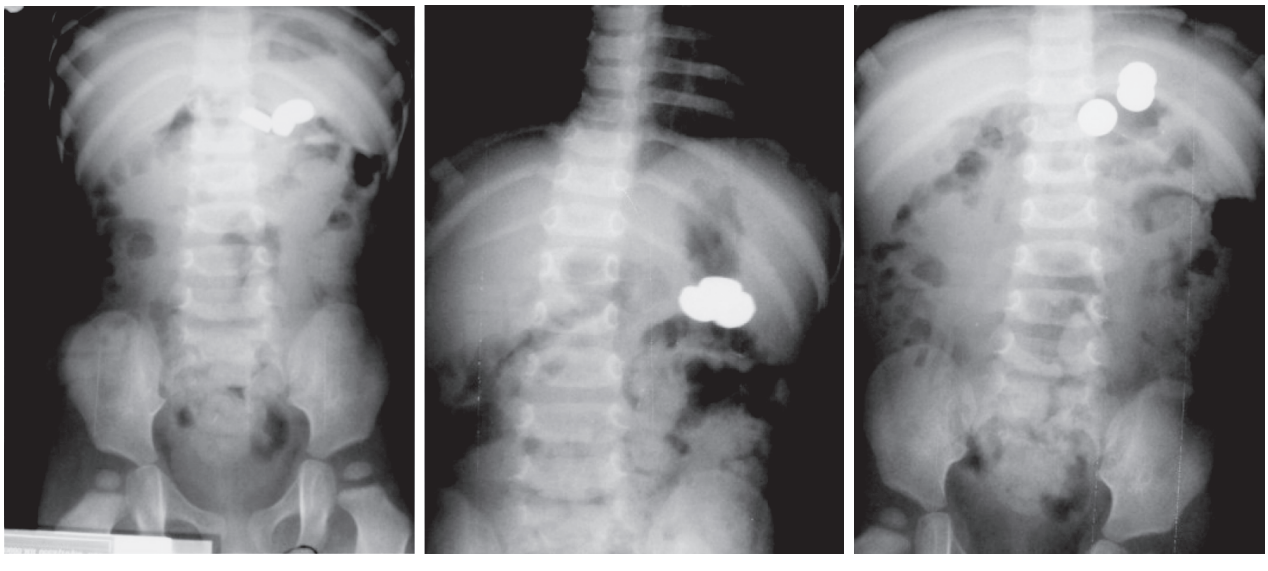


Figure 2 A boy with three button batteries in the stomach, which was successfully removed endoscopically

Table 2 Site of initial button battery lodging and clinical outcomes

Sites of lodging	No. (cases)	Successful endoscopic removal	Successful conservative treatment
Esophagus	1*	-	1*
Stomach	23	16	7
Small intestine	10	-	10
Large intestine	7	-	7

*One patient ingested two button batteries, one seen at the lower esophagus and one in the stomach. Battery at the esophagus spontaneously passed into the stomach and was conservatively treated.

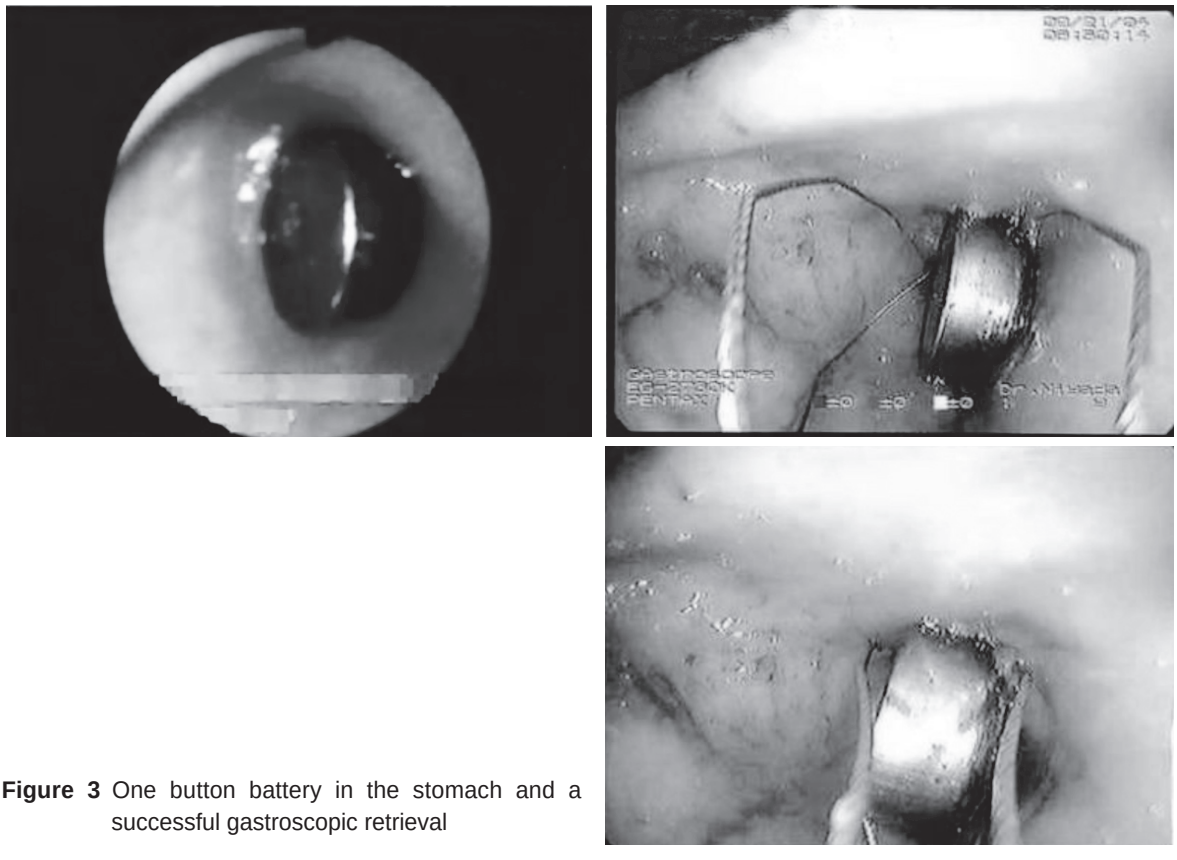


Figure 3 One button battery in the stomach and a successful gastroscopic retrieval

waiting for spontaneous passage of button batteries in the stomach was based on the judgement of each consultant surgeon. Seventeen patients who had button batteries located in the small and large intestine were successfully treated in a conservative manner, without the use of prokinetic drugs or laxatives. All button batteries were passed within two days.

The mean diameter of button batteries was approximately 12 mm (range 8 to 20 mm). The diameter of the button battery impacted at the esophagus was 18 mm. One battery impacted in the stomach for five days, and measured approximately 20 mm in diameter. The duration of hospitalization ranged from one to five days. All 40 patients made complete recovery after discharge.

Discussion

Several previous reports stated that button battery ingestion is most often seen in children aged five years or younger[2,4,10]. All patients in the present series were less than 5 years old and approximately 50% were 2 years or younger. Most children (80%) were asymptomatic after button battery ingestion. Only 20% of patients had symptom of vomiting, dysphagia and abdominal pain. According to the studies of Litovitz[2] and David[11], button batteries were mostly used in hearing aids, watches, games and toys, and calculators before being ingested. However, most of the ingested batteries in our patients were previously used in toys such as toy mobile telephones and remote controls of electric toy cars.

Almost all of the button batteries in the present study were small with the average diameter of 12 mm and fortunately can readily pass into the stomach and intestines. One of 40 patients was demonstrated to have a button battery lodged in the lower esophagus on admission, which spontaneously passed into the stomach within a few hours. No battery capsule separation was noted in our patients, even when the batteries were lodged in the gastrointestinal tract for as long as five days.

David and Ferguson[11] reported that 5% of their patients ingested more than one battery, and suggested that both chest and abdominal radiographs be obtained in every case. Button battery lodged in the esophagus

is a serious condition which may lead to sudden death, esophageal burn, esophageal perforation and tracheoesophageal fistula[4-8,11-14]. Most authors suggested that button batteries lodged in the esophagus require emergency esophagoscopic removal without delay[2,4,6,9-18].

The management of button batteries lodged in the stomach is more controversial: gastroscopic removal and conservative management are both advocated in the literature. Litovitz[2] suggested that button batteries arrested in the stomach were corroded more severely and fragmented more frequently than those arrested in the small and large intestine. Most investigators suggested that button batteries which have passed beyond the esophagus need not be retrieved[2,16-18]. Endoscopic removal of button batteries in the stomach should be done for patients presenting with vomiting, abdominal pain and other acute abdominal symptoms, or for a lodged battery of size greater than 20 mm in diameter or those remaining in the stomach for over 48 hours[2, 16-18].

A recent management guideline from the National Battery Ingestion Hotline (NBIH) has recommended conservative treatment in a child less than 6 years of age who had a small battery less than 15 mm in diameter lodged in the stomach. Gastroscopic removal should be done in patients with symptoms, or for batteries remaining in the stomach four days after ingestion[9]. We agree with the above criteria for conservative treatment, but would recommend endoscopic removal as soon as possible for the following: patients who are symptomatic, button batteries with a diameter larger than 15 mm that are lodged in the stomach, or button batteries lodging in the stomach for over 48 hours. Button batteries lodging in the small and large intestines conservatively treated will usually be passed with stool in 1-2 days.

Prevention plays an important role in button battery ingestion. The battery could be made more durable, suitable for prolonged lodging in the alimentary tract without rupture of the capsules. Labeling on the packaging could draw attention to the need to keep button batteries away from the reach of children[3,11]. Manufacturers could produce smaller button batteries (less than 16 mm) instead of larger ones (over 20 mm) in order to prevent lodging in the esophagus[19].

Conclusion

Children younger than five years are at risk for button battery ingestion. Batteries lodged in the esophagus should be immediately treated by endoscopic removal. Button batteries found in the stomach could be treated by endoscopic removal or conservative management. Most clinicians recommended that batteries arrested in the stomach for over 48 hours should be treated by endoscopic removal. Once the button cells have passed into the intestine, most will spontaneously pass through the rectum within 48 hours.

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