

Clinical Evaluation of Disc Battery Ingestion in Children

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ABSTRACT

BACKGROUND

The purpose of this study was to evaluate the characteristics, management, and outcomes of disc battery ingestion in children.

METHODS

We reviewed the medical records of children admitted to Mofid Children's Hospital due to disc battery ingestion from January 2006 to January 2010. Clear history, clinical symptoms and results of imaging studies revealed diagnosis of disc battery ingestion in suspected patients. The clinical data reviewed included age, gender, clinical manifestation, radiologic findings, location of disc battery, duration of ingestion, endoscopic results and surgical treatment.

RESULTS

We found 22 cases (11 males and 11 females) of disc battery ingestion with a mean age of 4.3 years (range: 9 months to 12 years). Common symptoms were vomiting, cough, dysphagia, and dyspnea. The mean duration of ingestion was 2.7 days (4 hours to 1.5 months). A total of 19 patients had histories of disc battery ingestion, but three cases referred with the above symptoms, and the batteries were accidentally found by X-ray. Only three cases had batteries impacted in the esophagus. Twelve batteries were removed endoscopically, 6 batteries spontaneously passed through the gastrointestinal (GI) tract within 5 to 7 days, and 4 patients underwent surgery due to complications: 3 due to tracheo-esophageal fistula (TEF) and 1 due to intestinal perforation. There was no mortality in our study.

CONCLUSION

Most cases of disc battery ingestion run uneventful courses, but some may be complicated. If the battery lodges in the esophagus, emergency endoscopic management is necessary. However, once in the stomach, it will usually pass through the GI tract.

KEYWORDS

Disc battery ingestion; Evaluation; Management; Complication; Children.

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INTRODUCTION

The incidence of ingestion of button batteries has increased during the past several years, with the increase in the availability of these devices.¹ More than 90% of swallowed batteries pass through the gastrointestinal (GI) tract and do not cause a problem. The narrowest area

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within the GI tract is the esophagus; therefore, it is the most common site of foreign body impaction. An esophageal foreign body may lodge in three distinct sites: the thoracic inlet, aortic arch area, and the gastro-esophageal (GE) junction. The most common sites of impaction are the thoracic inlet followed by the GE junction and the aortic arch. If a battery becomes impacted in the esophagus, it may penetrate the esophageal wall and cause a tracheo-esophageal fistula (TEF).^{2,3} Thus early diagnosis and extraction of the battery are very important. Flexible versus rigid endoscopy for removal of foreign body impaction in the esophagus is useful.⁴ The risk of development of TEF increases after the ingestion and its symptoms include food aspiration, fever, cyanosis, mediastinitis, pneumonia, and respiratory distress.⁵ The first step in suspected foreign body ingestion is a chest X-ray. In case more than several hours have passed since ingestion, it is recommended to perform a radiographic contrast test to rule out perforation.⁶ In some circumstances an esophageal foreign body may cause a mediastinal mass, which can be diagnosed by chest X-ray. Thoracotomy and fistula repair are also routine approaches.

MATERIALS AND METHODS

We reviewed the medical records of children admitted to Mofid Children's Hospital due to disc battery ingestion from January 2006 to January 2010. The diagnosis of disc battery ingestion was based upon history, clinical symptoms, and results of imaging studies. The clinical data reviewed included age, gender, clinical manifestation, imaging findings, disc battery location, time of ingestion, endoscopic results, and treatment.

RESULTS

A total of 22 patients (11 males, 11 females) were referred to our hospital due to disc battery ingestion, with a mean age of 4.3 years (range: 9 months to 12 years). The most common symptoms included vomiting, cough, dysphagia, and dyspnea. The mean duration of ingestion was 2.7 days (4 hours to 1.5 months). There were 19 patients with histories

of disc battery ingestion. However, 3 cases were referred with the above symptoms, and the battery was accidentally found during radiological studies. These 3 patients presented with intractable cough, mild cyanosis and dyspnea 18 days (5 to 45 days) after battery ingestion. All patients underwent chest X-ray examinations, and 17 cases received endoscopic studies. Three patients (14%) had esophageal battery impaction and 1 (4.7%) had small bowel impaction. The locations of disc batteries in the esophagus was 62% in the upper third (13 cases), and 19% in the lower third (4 cases). The others were: 2 in the stomach (9.5%) and 2 in the small bowel (9.5%). Figure 1 demonstrates an ingested disc battery in the upper part of the esophagus in a patient.



Fig 1: An ingested disc battery in the upper part of the esophagus.

The duration of batteries lodged in the esophagus ranged from 1 to 45 days, those in the stomach were lodged from 1 to 4 days, and in the case of intestinal perforation it was 15 days. Twelve patients with esophageal foreign bodies had their batteries removed successfully by endoscope within 3 to 5 hours of admission, but in 3 cases, batteries were removed later (up to 24 hours). The mean duration of disc battery ingestion for complicated cases was 18 days, in uncomplicated cases it was 3-5 days, and in endoscopic cases the mean duration was 1-3 days. Three cases, due to delayed admission and disc battery impaction after endoscopic removal developed TEF (Figure 2).

A thoracotomy with TEF repair was performed

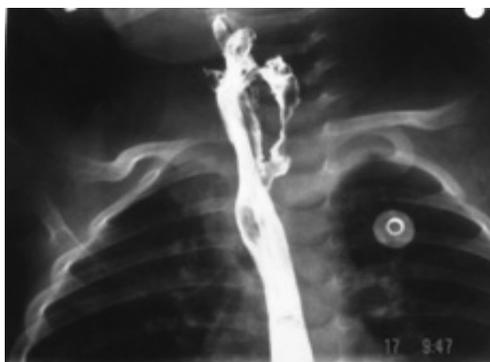


Fig 2: Demonstration of TEF in a patient.

for all three cases. No fistula was found in the post-operative barium swallow. One patient with a disc battery located in the stomach underwent laparotomy due to bowel perforation. After removal of the disc, resection and anastomosis was performed. In the other 6 patients, batteries spontaneously passed through their GI tracts within 5 days. Among the patients who underwent endoscopic removal of the battery in the esophagus, all pathologically revealed mucosal erosion with necrosis. The duration of hospitalization ranged from 1 day to 55 days. There was no mortality in our study group.

DISCUSSION

Children commonly place objects in their mouths. This often results in accidental swallowing of foreign objects. The male-to-female ratio in young children is 1:1, but in older children males are more commonly affected than females.⁷ Foreign body ingestion is a potentially serious problem that peaks in children 6 months to 3 years of age.⁸ Of foreign bodies ingested, 10%-20% fail to pass through the entire GI tract. Any foreign body that remains in the tract may cause obstruction, perforation or hemorrhage, and fistula formation.⁹ Disc batteries contain mercury, silver, zinc, manganese, lithium, sulfur oxide, copper, or steel as the components of the anode. The cathode also contains either sodium hydroxide or potassium hydroxide to facilitate the electrochemical reactions through electrolyte-soaked separation.^{10,11} The three most commonly involved battery systems are those with manganese

dioxide, silver oxide, and mercuric oxide. The alkaline solution is strong enough to cause rapid liquefaction necrosis of tissue.¹²⁻¹⁴ The esophagus is a passive and inadapted organ in which peristalsis may not be sufficient to pass large objects. For the same reason, perforation from a foreign body is more likely to occur in the esophagus than in the remainder of the tract. Perforation of the esophagus is dangerous because it may lead to parapharyngeal or retropharyngeal abscess, with possible descending mediastinitis. A fistula may rarely form with an adjacent vessel.^{9,15}

The narrowest area within the GI tract is the esophagus. Therefore, the most common site of foreign body impaction is the esophagus (16 cases in our series). The most common site of impaction is in the thoracic inlet as evidenced by 13 disc batteries located in the upper third of the esophagus in our study, followed by the GI junction (4 cases) and the aortic arch.¹⁶ Esophageal foreign bodies can produce symptoms of dysphasia, refusal to eat, drooling, coughing, stridor, vomiting, gagging, or regurgitation. In our series the symptoms were cough, cyanosis, dysphasia, choking, and vomiting, however, many children with esophageal foreign bodies are asymptomatic. Distal foreign bodies produce less specific symptoms.^{16,17} Classically, partially obstructive laryngeal foreign bodies are oriented sagittally at the level of the vocal cords, while esophageal foreign bodies are oriented coronally.¹⁰

Standard radiologic workup for suspected battery ingestion is the chest film, in both AP and lateral views, which we performed for all patients in the group. X-ray films have high availability, low cost, and high accuracy in outlining radiopaque objects.¹⁸ In the event of an impacted battery in the esophagus for more than several hours it is recommended to perform a radiographic contrast test to rule out perforation, but sometimes this may not be feasible because of technical difficulties and the risk of pulmonary aspiration. In these cases, a CT scan is helpful.^{6,19} Disc battery ingestion have traditionally been feared in children as they could cause corrosive injury.²⁰ A disc battery is removed endoscopy-

cally on an urgent basis if it is found to be in the esophagus;¹⁰ we removed 15 cases endoscopically in our series. Delayed diagnosis of an impacted battery is not uncommon, and may occasionally cause long-term complications, such as perforation or TEF.²¹ There were three cases of TEF in our series. The chances of perforation are very high after eight hours of retention at a specific site.⁶ Thoracotomy and fistula repair is a routine approach, as we have performed for 3 patients.²²

Most cases of disc battery ingestion run uneventful courses, but some may be complicated. If the battery impacts in the esophagus, emergency endoscopic management is necessary, but once in the stomach it will usually pass through the gastrointestinal tract.

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CONFLICT OF INTEREST

The authors declare no conflict of interest related to this work.

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