Case Report

Button battery induced traumatic tracheoesophageal fistula: Case report and review of literature

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ABSTRACT

Although accidental ingestions by children of various household chemicals and medicines are well described and the treatment is supported by protocols and hotlines, the ingestion of button batteries is less publicized, and the dangers are less understood by both parents and health care providers.

We describe the case of a three-year-old girl, who presented to hospital with respiratory distress, cough, and fever; three weeks after the ingestion of a button battery. Endoscopic examination revealed impacted 20 mm disc battery, which was removed, and a tracheoesophageal fistula (TOF) in the upper third of the oesophagus associated with severe oesophagitis, and oesophageal ulcers. There was also evidence of oesophageal fungal infection, and severe hyperemic pan-gastritis and duodenitis. Parents were counseled and conservative management advised, but they opted for surgical repair of the TOF. The operation was done and the child survived, but she ended up with a tracheal stricture and recurrent chest infections.

In conclusion, oesophageal button battery impaction places the patient at high risk for tracheoesophageal fistula. The key to successful therapy is prompt diagnosis and removal, which saves life and decreases morbidity. Because of the complications associated with this condition, patients should be managed at an institution with skilled personnel and facilities for advanced life support.

Key words: Foreign body; Accidents; Button battery; Dysphagia, Child; Sudan.

INTRODUCTION

Infants and young children explore their environment by placing objects in their mouth; and consequently ingestion of foreign objects is common in early childhood [1,3]. It is particularly common in toddlers who move around without close observation or attention from the mother or the caregiver. Studies

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How to cite this article:
Abdulkareem I, Sabir OM, Elamin A. Button battery induced traumatic tracheoesophageal fistula: Case report and review of literature. Sudan J Paediatr 2011;11(2):43-49.

have shown that in only 51% of these cases the ingestion is witnessed. This partly explains the delay in presentation and diagnosis [4,5]. Foreign bodies can go from the mouth to either the trachea or the oesophagus. For the purpose of this communication we deal with the osophageal ones. The foreign bodies ingested include pins, coins, pieces from toys, stones, solid seeds and plastic buttons; but the most notorious of all are disc batteries [6,9]. The disc or button batteries are small, disc-shaped power units commonly used in digital watches, hearing aids, calculators, cameras, blood glucose meters, some toys, and other electronic instruments. Although they are sealed, these batteries contain corrosive and toxic chemicals and heavy metals, including mercury, zinc, silver, nickel, cadmium, manganese, and lithium, together with a concentrated alkaline electrolyte solution of 26% to 45% potassium or sodium hydroxide [10,11]. These substances can leak if kept in contact with wet surfaces like mouth, oesophagus or trachea. Prolonged contact with oesophageal mucosa leads to extensive mucosal damage and inflammation. Exposure to the gastric acid in the lower oesophagus or the stomach increases the risk of leakage of the battery cell content [12].

There are four main types of these batteries; mercury, silver, alkaline manganese, and lithium. Lithium disc batteries have a power of 3 Volts, while the other three have a power of 1.5 Volts. Lithium containing batteries have the highest potential to cause mucosal damage, while zinc-air batteries are the least dangerous.

Oesophageal injury from button battery impaction can be attributed to the combined effects of five mechanisms: [1] alkaline electrolytes leakage from the battery, [2] 'de novo' alkali production from external current, [3] heavy metal toxicity, [4] direct flow of current causing low voltage burn, and [5] pressure necrosis. The corrosive contents of these batteries and the potential for metal poisoning are concerns often cited as a reason to institute aggressive therapy, that is, endoscopic or surgical battery retrieval in such patients.

CASE REPORT

A three-year-old Sudanese child was growing and developing normally and had no medical problems. Her story started three weeks prior to admission when her mother saw her ingesting a disc battery while she was playing with her toys. She immediately started coughing and salivating excessively. Mother tried to induce vomiting by placing her finger in the child's throat and managed to get some vomitus, but the battery did not come out.

The parents sought medical intervention at a nearby hospital. Clinical examination of the child revealed no respiratory distress and stable vital signs. The doctor on charge ordered a plain abdominal X-ray, which was reported as normal and no radio-opaque foreign body was seen in the stomach or the intestine. He reassured the parents and told them to examine the child's stools regularly for few days and if there is a foreign body in the gut it will come out.

Three weeks later, the child started to cough whenever she drinks or eats. Parents took her to hospital where she was seen by an ENT surgeon. He examined her and did a bronchoscopy and no foreign body was detected in the airway.

The child was then referred to the Gastroenterology Unit at Gaafar Ibn Oaf Children Hospital (GICH) for management. The standard medical care was given and, for logistic reasons, upper gastrointestinal (GI) tract endoscopy was performed at the Endoscopy Unit of the Military Hospital in Omdurman. The endoscopic examination found impacted 20 mm disc battery, which was removed, and revealed a tracheoesophageal fistula in the upper third of the esophagus (Figure 1) with severe oesophagitis, and oesophageal ulcers. Also found was evidence of oesophageal fungal infection (Figure 2), and

severe hyperemic pan-gastritis and duodenitis. A barium swallow with gastrografin was then done and confirmed the tracheoesophageal fistula with the dye entering the trachea (Figure 3).

A nasogastric tube was fixed for feeding and she was referred to a pediatric surgeon. The surgeon explained to the parents that there are two options for treatment. Either a conservative management by using a nasogastric tube for feeding and symptomatic treatment as needed, while awaiting the fistula to close spontaneously with time, which he personally prefers, or surgical intervention, which is very hazardous and has great risks of serious complications.

Unfortunately, the parents decided to take chance and took the child abroad for surgical repair. The operation was done and the child survived, but she ended up with a tracheal stricture. The consequence of that complication is frequent attacks of chest infections and breathing difficulty. Currently she is being followed up by an ENT surgeon and our Unit for symptomatic treatment.

Figure 1: Tracheoesophageal fistula in upper oesophagus

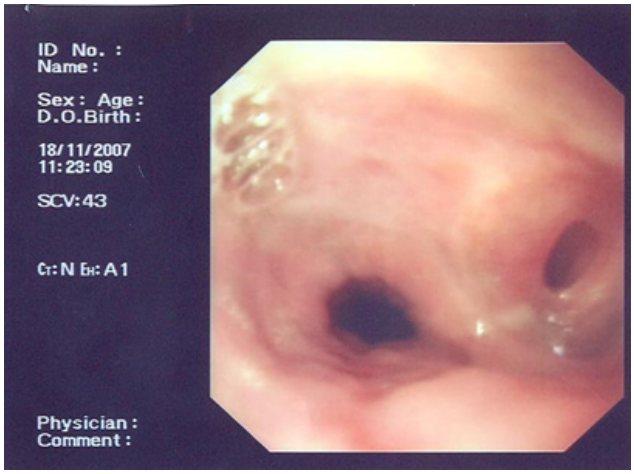

Figure 2: Ulceration and fungal infection of the oesophagus

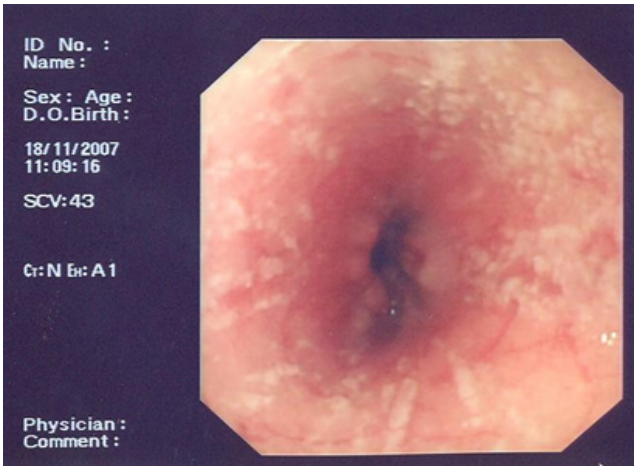

Figure 3: Barium swallow showing dye in the trachea

DISCUSSION

To our knowledge, this is the first reported case of button battery ingestion in Sudan. The largest series of such cases is the American National Button Battery Ingestion (NBBI) survey, in which 2320 cases of button battery ingestion were collected and reviewed [13]. In that study, children less than 5 years of age were the most frequently affected accounting for 61.8% of ingestion cases. One tenth of the patients were symptomatic, and a more diverse set of presentations was reported, with most symptoms related to the GI tract. In that series, only 16 patients (0.7%) had oesophageal impaction and two of those patients ended up with oesophageal stricture.

Based on their findings in the NBBI survey, Litovitz and Schmitz [13] advocated a noninvasive approach for most cases of button battery ingestion where an oesophageal impaction was excluded, unless the patient showed signs or symptoms indicative of GI tract injury or a large diameter cell failed to negotiate the pylorus. In contrast to this, they recommend that batteries lodged in the oesophagus should be removed immediately. Complications of oesophageal button battery impaction have included tracheoesophageal fistula, vocal cord paralysis, esophageal burns with or without perforation, and aortoesophageal fistula [14,18]. Burns have occurred in as little as 4 hours after ingestion, and perforation within as short a timeframe as 6 hours [19]. All reported cases have been associated with symptoms of irritability, pain, dysphagia, vomiting, or refusal to eat. An X-ray film should be obtained promptly at presentation to determine the battery's location [20]. In the NBBI series, at least 13.4% of the patients who ingested batteries did not undergo diagnostic X-ray localization. Some authors have proposed various methods of blind retrieval of batteries from the oesophagus [21,22]. However, these methods did not allow direct inspection of the oesophagus to determine the extent of injury and the presence of perforations or other complications. The majority of batteries that lodged in the oesophagus and caused oesophageal injury were of large diameter (>20 mm), with only a few exceptions, mainly in infants [23].

When treating a patient that has ingested a button battery, the first step is to assess and maintain a patent airway and adequate ventilation. Induction of emesis is ineffective in removing batteries from the stomach and risks aspiration and oesophageal or gastric perforation, and should therefore be avoided [24]. Activated charcoal is also ineffective in managing alkali and metal poisoning and may mask hematochezia. H2 receptor antagonists and antacids have been used empirically for batteries lodged in the oesophagus and stomach, and laxatives have been used to speed passage through the small and large bowels [25]. However, Rivera and Mares [26] found no benefit from local administration of a neutralizing agent on oesophageal burns. On the other hand, antacids containing aluminum or magnesium hydroxide were effective in reducing gastric burns in some studies [27]. When the battery has passed beyond the oesophagus, the patient should be observed for the presence of persistent vomiting, tarry or bloody stools, abdominal guarding or tenderness, poor appetite, fever, dyspnea, or any signs of toxicity. Hospitalization is seldom required when the patient is asymptomatic, and discontinuation of oral intake is not necessary for patients in whom the batteries have already passed through the oesophagus, as it may delay gastric transit times. Repeat X-rays are indicated only when battery passage has not been confirmed within 4 to 7 days, and more frequent X-rays may be needed in patients less than 6 years of age who ingest batteries larger than 15 mm in diameter [28]. When mercury poisoning is suggested, especially in patients where the batteries split in the gastrointestinal tract or radiopaque droplets are evident in the gut X-ray films, determination of blood and urine mercury levels may be helpful in assessing the severity of poisoning and

the need for chelation therapy [29]. In the NBBI series, no clinical evidence of mercury toxicity occurred, although one patient demonstrated minimal elevation of blood mercury levels.

Various treatment modalities have been advocated for the closure of acquired tracheoesophageal fistula, but spontaneous closure may occur without surgical intervention [30,32]. Senthikumaran et al [33] noted that when the oesophagus was given total rest and the peri-oesophagitis settled quickly, there was a fair chance that the fistula may heal spontaneously. Samad et al [34] recommended that a nonsurgical approach should be adopted after button battery removal, even when oesophageal perforation was noted. On the other hand, Litovitz [35] reported five cases in which the batteries were lodged in the oesophagus. Two of the patients died, one from an aortoesophageal fistula, and the other from a massive tracheoesophageal fistula and subsequent exsanguinations. One patient developed a tracheoesophageal fistula and was successfully resuscitated from a cardiac arrest. Patients who develop tracheoesophageal fistula carry a high risk of morbidity and mortality [36]. The choice of surgical intervention depends on not only whether the fistula will heal spontaneously, but also whether the patient risks serious complications such as aspiration pneumonia or hemorrhage [37].

In summary, the salient points in the management of patients with button battery ingestion include: 1) early X-ray localization of the battery, 2) identification of the diameter and composition of the battery, 3) endoscopic removal of the batteries lodged in the oesophagus, and 4) supportive treatment for patients with batteries that passed the oesophagus. For patients with oesophageal perforation or tracheoesophageal fistula, conservative treatment should be attempted first with extreme caution and close monitoring.

In conclusion, ingestion of foreign body is common in young children and can cause serious problems. Early recognition and appropriate intervention reduce morbidity, but prevention by increasing awareness of parents and setting child protection policies is the best effective approach. The following points need to be emphasized in parents' education: 1) it is most important for child safety to keep dangerous materials out of the reach of children, 2) parents should avoid buying their children toys which contain small parts that might be ingested or inhaled easily, and 3) adult supervision when children play with toys is essential because it may pose a health hazard.

ACKNOWLEDGEMENT

We are very grateful to Dr. Osama Aljemeabi and the Staff of the Endoscopy Unit of Omdurman Military Hospital for their valuable assistance.

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