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A DANGEROUS ENCOUNTER OF BUTTON BATTERY INGESTION IN A TODDLER - COMPLICATIONS AND POST REMOVAL MANAGEMENT CHALLENGES

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ABSTRACT

Button battery ingestion (BBI) in toddlers is a paediatric emergency requiring immediate endoscopic or surgical intervention, as delayed treatment can be fatal. The ideal removal window is within 2 hours, but this is often missed due to nonspecific symptoms. Prolonged exposure to the battery's corrosive effects can cause severe complications, including tracheoesophageal fistula (TEF) and aortoesophageal fistula (AEF), which may be fatal. Reported the case of a 2-year-3-month-old boy who presented to the Emergency Department three days after ingesting a 3×3 cm button battery. His non-specific symptoms led to a missed diagnosis during an earlier visit to a general practitioner. Diagnosing the condition was further complicated by the absence of significant findings on physical examination. However, a detailed history revealed the sudden onset of symptoms and an episode of unsupervised play before symptom onset, raising suspicion of foreign body ingestion. An immediate anteroposterior and lateral neck and chest X-ray confirmed the diagnosis. The button battery was successfully removed endoscopically. However, the delayed presentation resulted in complications, including mucosal injuries and pus collection. The patient received intravenous fluids, antibiotics, and steroids to prevent further complications. In this case, the child's non-citizenship status and financial constraints posed additional challenges to proper post-removal monitoring and surveillance. This case report highlights the importance of early recognition of BBI in high-risk groups as a paediatric emergency and emphasizes the need for diligent post-removal surveillance. Ultimately, this report underscores the critical role of timely intervention and preventive measures in such cases.

1.0 INTRODUCTION

Button battery ingestion (BBI) epitomizes the challenges of paediatric foreign body ingestion, a paediatric emergency with outcomes ranging from harmless expulsion to fatal complications [1-2]. Although the rate of battery ingestion per million population has remained stable among children over the past 30 years, data from the National Electronic Injury Surveillance System indicate that the absolute number of emergency department visits for battery-related injuries more than doubled between 1990 and 2009 [1]. Similarly, a cohort study using data from the National Capital Poison Centre reported a 6.7-fold increase in button battery ingestions from 1985 to 2009 [3-4]. Children aged 1–2 years are the most affected, as their natural curiosity and developmental stage make them more likely to place objects in their mouths. Additionally, their smaller oesophageal diameter increases the risk of foreign body impaction [1-2, 4]. Data from the National Capital Poison Centre indicate that nearly half (46.3%) of BBI-related fatalities are attributed to aortoesophageal fistula (AEF). Tissue injury begins within minutes of BBI and serious injury can occur within 2 hours, hence time is a crucial factor at presentation [5]. Prolonged exposure to the corrosive effects of button batteries can result in severe complications, including tracheoesophageal fistula (TEF) and aortoesophageal fistula (AEF) [6]. Rapid diagnosis and prompt management are crucial for improving survival outcomes in affected infants [6].

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2.0 CASE PRESENTATION

A 2-year-3-month-old boy with no known medical history presented to the Emergency Department with a three-day history of reduced oral intake, vomiting, and noisy breathing. According to his mother, symptoms began three days prior while he was playing unsupervised with his older brother (aged 6 years). The child subsequently complained of anterior neck pain and had two episodes of vomiting. He was unable to tolerate solid food and vomited after consuming formula milk. The vomiting persisted, occurring more than 10 times per day, and was non-projectile, non-bilious, and without hematemesis. Later that day, he developed a persistent dry cough and intermittent noisy breathing, followed by a high-grade fever (39.8°C) and lethargy. The day before admission, he visited a general practitioner, where he received symptomatic treatment and two nebulization sessions that provided temporary relief. However, his symptoms persisted the following day and he was therefore brought to the Emergency Department for further evaluation.

Upon further inquiry, the mother denied any history of choking or cyanosis. She also reported no awareness of any missing toy parts. The patient was otherwise healthy, with normal developmental milestones. The child is not a Malaysian citizen, and the family relies on daily wage labour with inconsistent income. On examination, the patient was alert and had normal skin coloration. His respiratory rate was 32 breaths per minute, with no chest recession. There was no audible stridor or wheeze. Apart from fever, his vital signs were stable. There was no neck swelling, lung sounds were clear, and the abdomen was soft and non-tender. An ear, nose and throat examination revealed mildly injected but non-enlarged tonsils. Other systemic examinations were unremarkable. Laboratory findings showed leucocytosis (total white cell count: 23×10^9/L), anaemia (haemoglobin: 10 g/dL), and a normal platelet count (381×10^9/L). Baseline renal and liver function tests were normal. Chest radiography revealed a 3×3 cm round opacity in the oesophagus at the C7-C9 vertebral level, with a double ring (halo) sign, highly suggestive of a button battery. A lateral neck radiograph confirmed the location. Flexible nasopharyngolaryngoscopy showed a patent airway with no pharyngeal or laryngeal abnormalities.

Four hours after admission, the patient underwent esophagoscopy, and the button battery was successfully removed using crocodile forceps. The battery was visualized 11–13 cm from the central incisors. The anterior oesophageal wall showed erosion, sloughing, and copious pus collection on the left side, but no mucoid discharge or active bleeding was observed. Post-procedure, the patient received intravenous fluids, antibiotics (Augmentin, Flagyl), and steroids to prevent complications. He was closely monitored for clinical signs of dysphagia, respiratory distress, and sepsis. A contrast-enhanced CT scan of the neck and thorax was planned to assess post-BBI removal complications. However, patient's family was unable to cover medical expenses. He was monitored in the general paediatric ward for 1 week while the hospital assisted in contacting non-governmental organization and medical social officers for financial aid. Unfortunately, despite extensive counselling on risks including oesophageal perforation, mediastinitis and sepsis the family insisted on discharge against medical advice due to their social circumstances. Before discharge, the family was educated on recognizing signs of potential complications, including sepsis and oesophageal strictures. They were advised to seek immediate medical attention if the child exhibited any concerning symptoms. The child was given oral antibiotics and an appointment to be reviewed in the clinic.

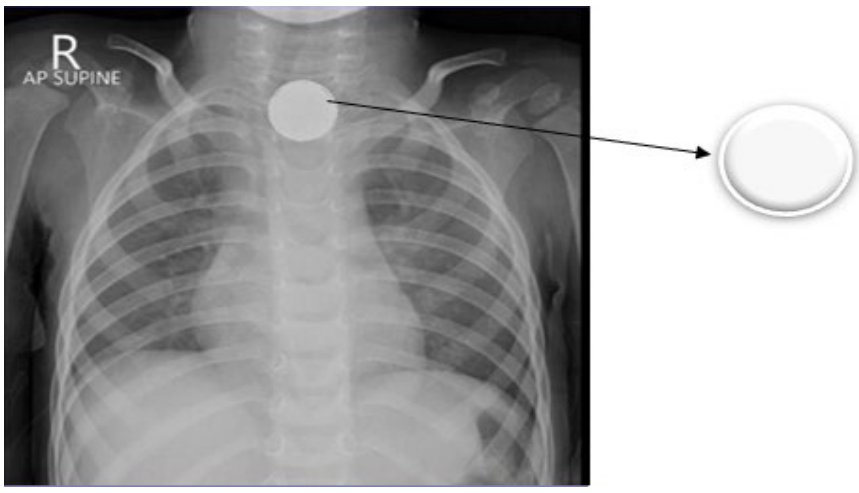

Figure 1. Chest radiograph AP view of the patient

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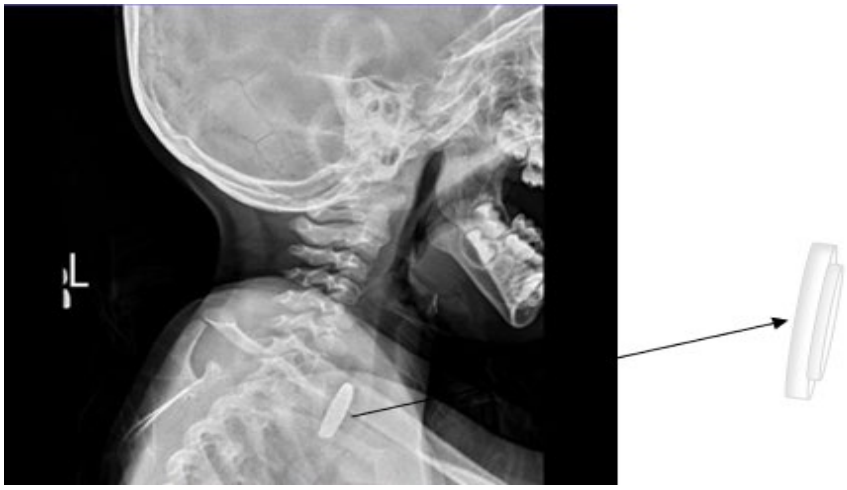

Figure 2. Lateral neck radiograph

Figure 1 shows Chest Radiograph AP view of the patient. A radio-opaque, circular foreign body (3x3cm) is seen at the C7-C9 vertebral level. The "double ring" or "halo" sign is clearly seen, a key radiographic feature distinguishing button batteries from other ingested foreign bodies, such as coins. Figure 2 shows Lateral Neck Radiograph. An opacity is seen within the oesophagus at the vertebral level of C7-C9. The step-off or bevelled edge distinguishes between a coin and a button battery.

3.0 DISCUSSION

Foreign body ingestion is often perceived as less severe than aspiration; however, this assumption does not hold in the case of BBI. The unique chemical and electrical properties of button batteries cause rapid and extensive damage to the oesophageal mucosa, exacerbated by the presence of electrolytes in saliva.

3.1 Overcoming Diagnostic Challenges in Paediatric Button Battery Ingestion

Diagnosing BBI in children is often challenging, as its presentation is frequently non-specific and can range from asymptomatic cases to massive hematemesis, depending on severity. According to the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN), younger children may present with a variety of gastrointestinal and respiratory symptoms, including vomiting, drooling, irritability, coughing, stridor, dyspnoea, hematemesis, haemoptysis, melena, weight loss, and hoarseness of voice [11]. These diverse symptoms highlight the broad spectrum of clinical manifestations associated with BBI. Therefore, obtaining a detailed history including the sudden onset of unexplained respiratory or gastrointestinal symptoms, particularly if there is a history of unsupervised play, access to batteries, or missing household batteries can provide crucial clues for timely diagnosis.

The radio-opaque nature of a button battery makes X-ray imaging highly valuable in confirming the diagnosis. It is crucial to differentiate a button battery from other ingested foreign bodies, particularly coins, due to the urgent need for intervention [8]. Unlike an ingested coin, which can often be managed conservatively, a button battery must be removed as soon as possible to minimize the risk of severe complications. The key distinguishing radiographic features of a button battery include: (a) A radiopaque shadow (b) The double halo sign (caused by the battery's layered structure) (c) A step-off shadow, corresponding to the negative pole of the battery (Refer to Figures 1 and 2 for radiographic features).

3.2 The Urgency of Timely Removal

Time is of the essence in these cases, as delayed diagnosis significantly increases the risk of severe complications, including potentially life-threatening outcomes. Button batteries lodged in the oesophagus can lead to chemical burns, tissue necrosis, and perforation, necessitating urgent diagnostic investigations, particularly when symptomatic evidence is present. A diagnosis delayed beyond 12 hours post-ingestion or in the presence of symptomatic indicators of serious complications, such as hematemesis, may require CT imaging to evaluate the extent of vascular involvement and to guide appropriate management strategies [10]. The oesophagus is particularly susceptible to caustic injury due to the buildup of sodium hydroxide, driven by salivary electrolysis. This leads to liquefactive necrosis, which can progress to perforation,

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affecting airways, major arteries, or even the vertebral column [5-8]. Even if the battery passes into the stomach, the risk remains, as oesophageal and surrounding tissue necrosis can continue, leading to fistula formation and severe complications. Early recognition of ingestion and rapid coordination of transfer to a paediatric tertiary centre for endoscopic removal of the button battery is essential to minimize the duration of impact [14].

3.3 Post-Removal Care: Monitoring for Hidden Complications

Monitoring for complications is a critical aspect of post-removal management. Critically, liquefactive necrosis may persist even after battery removal, underscoring the need for close post-removal monitoring [1-6]. Difficulty swallowing, drooling, refusal to eat or drink, or the sensation of food getting stuck may indicate oesophageal injury. Fever, chest pain, tachycardia, and an elevated white blood cell count could suggest infection, mediastinitis, or oesophageal perforation. Additionally, hoarseness, a weak cry, or stridor may signal the involvement of the vocal cords. Several studies consistently highlight the importance of post-removal management and re-evaluation to detect potential complications, which include oesophageal perforation, bleeding, mediastinitis, vocal cord paralysis, tracheoesophageal and aorto-oesophageal fistulas, retropharyngeal abscess, spondylodiscitis, recurrent laryngeal nerve injury, pneumonia, sepsis, and long-term oesophageal stricture [9-12].

3.4 Long-Term Surveillance to Prevent Delayed Complications

A significant challenge in post-removal care is the risk of severe complications, which can arise days, weeks, or even months after removal due to persistent alkaline-induced liquefactive necrosis [6]. Furthermore, oesophageal cicatricial stenosis a narrowing of the oesophagus caused by scar tissue formation may develop 6 to 8 months after the removal of a button battery lodged in the oesophagus. This condition often manifests with symptoms such as difficulty swallowing (dysphagia) and a preference for liquid diets. A structured approach of long-term monitoring for toddlers or children who have ingested button batteries is essential to identify and manage potential delayed complications. Schedule follow-up appointments with a paediatrician or gastroenterologist at 1 week, 1 month, 3 months, and 6 months post-removal, or as recommended based on the severity of the initial injury.

3.5 Prevention and Education: The Best Defence Against BBI

Given the potential for delayed complications following BBI removal, it is critical to educate patients and caregivers on recognizing relevant symptoms. They should be advised to seek immediate medical attention if any concerns arise, as prompt intervention is essential to improving patient outcomes. Parents and caregivers should be informed about potential delayed complications, such as fever, difficulty swallowing (dysphagia), or respiratory issues, and strongly encouraged to act quickly if these or other concerning symptoms develop.

4.0 CONCLUSIONS

The management of button battery ingestion necessitates a multidisciplinary approach due to the potential for severe and diverse complications that can impact multiple organ systems. The complexity of such cases underscores the importance of collaboration among various medical specialties to ensure thorough evaluation, timely intervention, and effective long-term management. Acute complications often require immediate, coordinated care, while delayed sequelae, such as strictures or fistulas, may necessitate prolonged follow-up and rehabilitation. A comprehensive, holistic strategy is essential to address not only the immediate medical and surgical needs but also the nutritional, developmental, and psychosocial aspects of care, ensuring optimal outcomes for the affected child.

5.0 CONFLICT OF INTEREST

The authors declare no conflicts of interest.

6.0 AUTHORS CONTRIBUTION

Sarman, M. (Conceptualization; Literature review; Clinical data collection; Writing of original draft)
Lim, P. P. (Literature review; Writing and critical revision of the article for important intellectual content)
Abu Bakar, M. (Writing and Critical revision of the article for important intellectual content)

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