Case Report

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Repair of tracheo-oesophageal fistula secondary to button battery ingestion: A combined cervical and median sternotomy approach

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ABSTRACT

A three-year-old child developed a large tracheo-oesophageal fistula secondary to a button battery being lodged in the upper oesophagus for 36 hours. The diagnosis was confirmed with a contrast swallow. Operative access was gained through a combined right cervical incision and complete median sternotomy. Repair of the fistula required a segmental resection of both the trachea and oesophagus followed by primary anastomosis.

Key words: Acquired tracheo-oesophageal fistula, button battery, median sternotomy

CASE REPORT

A three-year-old girl who was previously fit and well was brought to Chris Hani Baragwanath Academic Hospital with a history of difficulty in swallowing. There was a history of ingesting a button battery the day before. The child was not in respiratory distress, and there was no drooling of saliva. An X-ray revealed a button battery lodged in the upper oesophagus with characteristic peripheral lucency [Figure 1]. There was no evidence of pneumo-mediastinum. The child was taken to theatre where a rigid oesophagoscopy was performed and the battery removed. No obvious fistula was documented at the time. However, on the first post-operative day, the child presented with a significant cough and evidence of aspiration after taking liquids by mouth. A water-soluble contrast swallow demonstrated a large tracheo-oesophageal fistula at the level of C7-T1 [Figure 2], and the patient was admitted to the paediatric intensive care unit where she was intubated and a nasogastric tube passed. Operative repair of the fistula was planned for the following day.



Figure 1: Plain x-ray showing button battery in the oesophagus with its characteristic peripheral lucency



Figure 2: Water-soluble contrast swallow demonstrating a tracheo-oesophageal fistula

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The initial approach was via an incision along the anterior border of the right sternocleidomastoid through which the site of the fistula was identified, approximately at the level of the sternal notch. To improve access, particularly with respect to adequate mobilization of the distal trachea and oesophagus, the incision was extended to a complete median sternotomy. The trachea and oesophagus were controlled above and below the level of the fistula, which was approximately 1.5 centimetres in length. The trachea and oesophagus were mobilized, taking care to identify and preserve the recurrent laryngeal nerves. Resection of the necrotic circumference of both the trachea and oesophagus was done. This amounted to three tracheal rings in the trachea, which left a 3-4 cm gap between the proximal and distal tracheal ends with the endotracheal tube traversing the defect [Figure 3]. The child tolerated this well with no deterioration in oxygenation or ventilation. An end-to-end anastomosis of both trachea and oesophagus was done using 4-0 polydioxanone, which was achieved without tension due to the prior mobilization [Figure 4]. The right sternohyoid muscle was detached superiorly and swung down and placed between the two repairs to minimize the risk of re-fistulization. A nasogastric tube was passed across the oesophageal anastomosis, and a penrose drain was placed next to both repairs and exited via the right neck incision. The child was left intubated and transferred back to ICU. On the 7th post-operative day, a flexible bronchoscopy was performed to confirm the integrity of the tracheal repair prior to extubation. No saliva had drained from the penrose drain, and the child was started on nasogastric and subsequently oral feeds. On the 10th post-operative day, she developed a fever that was investigated with a CT scan with oral contrast. No leak or recurrent tracheo-oesophageal fistula was demonstrated, but a small collection was noted in the region of the anastomosis. On the 12th post-operative day, saliva and milk were noted in the penrose drain. Due to the complexity of a full re-exploration to attempt to repair the leak, it was deemed prudent to divert the child with a cervical oesophagostomy and insert a feeding gastrostomy. Three months later, when her general condition had improved, she was taken back to theatre and oesophageal continuity was re-established.

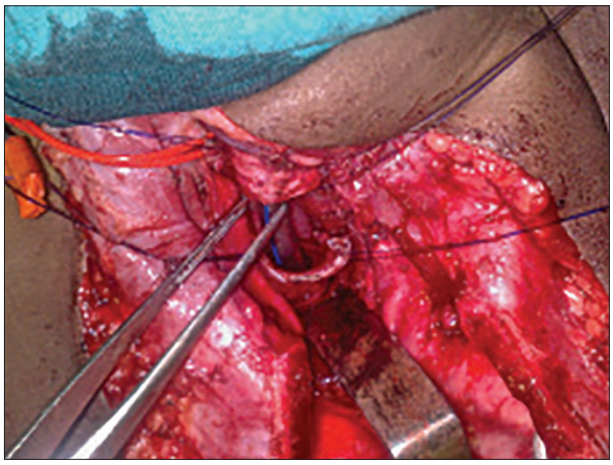


Figure 3: Resection of unhealthy portion of trachea with an endotracheal tube traversing the defect

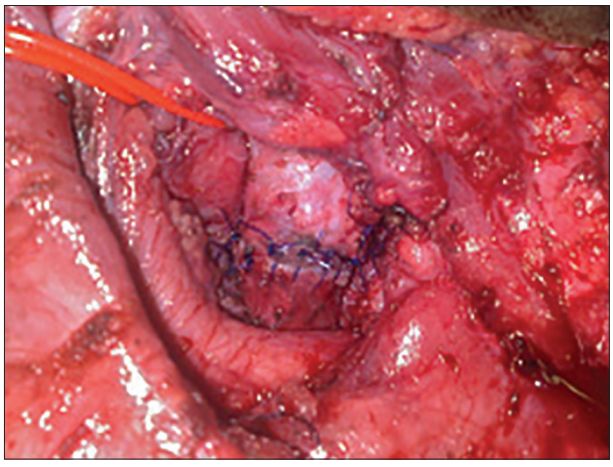


Figure 4: Completed tracheal repair. Oesophageal repair is hidden behind

DISCUSSION

Button battery ingestion is a potentially lethal condition. With their widespread necessity to operate household goods, their accidental ingestion by children is increasing. In a review of over 8000 cases by Litowitz, it was noted that in 64% of cases, children gained access to button batteries by directly removing them from an appliance.[1]

Most ingestions are not witnessed and, therefore, these children may present late or with non-specific signs and symptoms that will delay the diagnosis. There is now increased availability of the 20-25 mm lithium battery that is replacing previous smaller batteries. This has clinical implications for two reasons. Firstly, the larger battery has an increased risk of being held up in the oesophagus. Secondly, these newer batteries have a higher charge and can, therefore, cause more tissue damage. Injury to the oesophagus can occur as early as two hours after ingestion.[2] The mechanisms by which button batteries cause tissue damage is by direct electrical burn, leakage of caustic contents (this was more important for "older generation" alkaline batteries and does not apply for the newer lithium batteries) and by direct pressure necrosis. It is at the negative pole of the battery where electrolysis produces hydroxyl ions leading to tissue damage. This is the narrower side of the battery, and the mnemonic 3N can be used to remember this: Narrow – Negative – Necrosis.

In un-witnessed ingestions, a high index of suspicion is needed for an early diagnosis.[3] The investigation of choice is a plain X-ray. This will show the characteristic peripheral lucency that differentiates a battery from a coin, converting a semi-urgent situation to an urgent one. Batteries that are in the stomach can be left to pass spontaneously, but it is recommended that an x-ray be repeated after four days if they have not passed by then.[2] Batteries that remain in the stomach at that time should be removed.

Oesophageal impaction of a battery can lead to a variety of morbidities including local necrosis, perforation or stricture, tracheo-oesophageal fistula, vocal cord paralysis or aorto-oesophageal fistulae. There have been 13 reported deaths from button battery ingestion: All from fistulization into major vessels. More that 90% of serious or fatal outcomes occurred in children under 4 years of age. In an analysis of risk factors that lead to increased morbidity, the most important were battery size greater than 20 mm and age under four years.[2]

Treatment of button batteries lodged in the oesophagus is urgent endoscopic removal. It should be noted that associated complications may have a delayed presentation with tracheo-oesophageal fistulae having been being reported six days after removal and major bleeding up to 18 days after removal.[2,3] Suspicion of a tracheo-oesophageal fistula can be assessed with a contrast swallow as in our patient; alternately a CT scan with virtual bronchoscopy has successfully confirmed the diagnosis.[4] Conservative management of acquired fistulae with spontaneous closure has been reported, but this may require a tracheostomy and prolonged nasogastric or jejunostomy feeding.[5,6] Many cases will require surgical intervention, particularly if the fistula is large.[6] The usual approach is via the neck if the fistula is in the cervical oesophagus, the most likely position for a battery to lodge. The fistula is divided with repair of both trachea and oesophagus as performed for a congenital H-type tracheo-oesophageal fistula. It is important to interpose tissue between the two suture lines to prevent re-fistulization. Our case demonstrates a more difficult situation where the fistula was too low to repair via an isolated cervical incision and required additional access via a median sternotomy. As the fistula was large with friable adjacent trachea and oesophagus, it required more extensive mobilization of the proximal and distal ends prior to repair. The sternotomy gave excellent exposure and allowed for adequate mobilization of the structures, enabling a tension-free anastomosis. The child could be appropriately ventilated despite the trachea being completely divided as demonstrated in Figure 3.

CONCLUSION

This case emphasizes a known serious complication of button battery impaction in the oesophagus. It also demonstrates how combining a cervical incision with a median sternotomy can give excellent exposure and allow for safe resection and anastomosis in those cases that have large fistulae with more extensive involvement of the adjacent trachea and oesophagus. There were no sources of support or conflicts of interest in the preparation of this manuscript.

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