Button Battery in the Ear

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Abstract

The usage of button batteries has increased with the miniaturization of electronic devices resulting in easy availability of the button batteries to the young children. While there are numerous reports of lodgment and associated complications of button batteries in the gastrointestinal tract, there are only a few reports relating to ear. A report of two cases of children aged 4 and 5 years old with impacted button battery and associated complications in the ear is presented.

INTRODUCTION

Button batteries are small, shiny and often attractive to children, these pose a potential danger as foreign bodies. The large sized cells are implicated in gastrointestinal tract complications; on the other hand small size button batteries are no less destructive in areas with small orifices like the external ear. A Pub Med search (till October 2011) using the keywords button battery, ear and external auditory canal retrieve only a few such reports[1-7]. We report two cases of button battery impaction with associated complications in the external auditory canal.

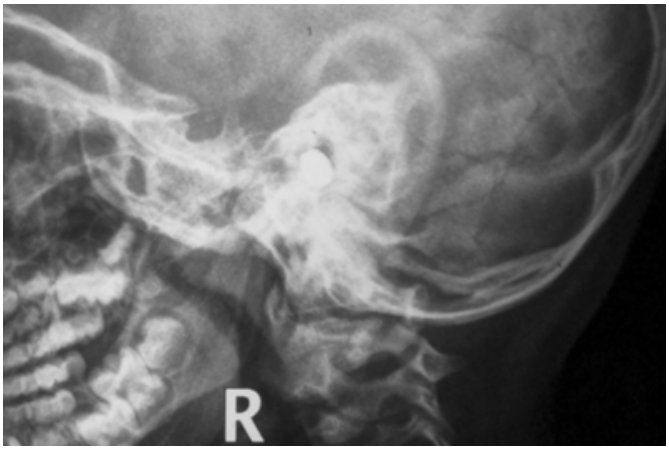
CASE REPORT

A 5 year old male child presented with 6 hour history of pain after putting something in the right ear in the ENT outpatient department of PGIMS Rohtak, Haryana, India. There was no other significant history.

General physical examination was normal. Otorhinolaryngological examination of the ear revealed a metallic foreign body in the right external auditory canal (EAC) of approximate size 0.5 x 0.5 cm associated with some redness and swelling of the EAC. The routine radiological and blood investigations were normal. An X-ray mastoid lateral-oblique view both mastoids revealed a metallic double contoured foreign body in the right EAC. (Figure1).

Figure 1

Figure 1: X-ray mastoid showing the button battery impacted in the external auditory canal.



The metallic foreign body removed under general anesthesia was found to be a 5mm diameter button battery. The skin of the EAC and the tympanic membrane was congested but no perforation was noted. The child was advised oral antibiotics and antibiotic and steroid drops for a week. On post operative follow up visit the congestion has resolved.

CASE 2

A 4 year old male child presented with one day history of foreign body insertion in the left ear. There was a history of failed attempt for foreign body removal by a non-otolaryngologist, who also advised some otic drops. The patient's ear pain increased and he was brought to the emergency department of PGIMS Rohtak, Haryana, India.

General physical examination was normal. Otorhinolaryngological examination of the left ear revealed blackish ear discharge, blackish discoloration of skin of

external auditory canal and a metallic foreign body over the tympanic membrane. Under general anesthesia the skin of the meatus was found eroded and the tympanic membrane was perforated in the antero-inferior quadrant. A corroded button battery was found partially impacted in the middle ear through this perforation was removed. The child was advised oral antibiotics and antibiotic and steroid drops for a week. On post operative follow up at three months the congestion has resolved but the perforation of tympanic membrane persisted.

DISCUSSION

Button batteries can produce rapid tissue destruction on contact with tissue. These contain a metal anode, generally zinc and a metal oxide cathode, immersed in a strong alkaline solution commonly 45% potassium hydroxide. Various mechanisms have been proposed to explain the tissue damage. Leakage of alkaline electrolyte solution can occur in the moist environment. Crimp area corrosion occurs at more rapid rate when the battery is immersed in an electrolyte solution such as gastrointestinal and nasal sections and otic drops. Batteries immersed in an acidic medium undergo corrosive reaction that results in dissolution of steel casing and formation of soluble iron, facilitating disassembly. Batteries in neutral medium form iron oxide and hydroxide precipitates. On disintegration of these batteries leakage of alkali occurs.[1,5,7]

The second mechanism of tissue electrolysis is by low voltage direct current set up between the anode and cathode. Button batteries cause cumulative electric current burn by low voltage direct current passing between anode and cathode via tissues of external auditory canal. Exudation of tissue fluids caused by a burn injury creates a moist environment leading to the leakage of the battery alkaline solution.[1,5,7]

This is confirmed by in-vitro studies which indicate that a spontaneous leakage of electrolyte solution occurs when alkaline batteries are exposed to moisture[8]. The leaked alkaline solution has the ability to penetrate deeply into tissues producing liquefying necrosis. This results in dissolution of protein and collagen, saponification of lipids, dehydration of tissue cells and extensive tissue damage.[8,9]

The third mechanism involves pressure necrosis which can occur in any type of foreign body impacted in a given area for a prolonged period. Button batteries cause tissue destruction probably by a combination of all three mechanisms.[1,5,7]

The button battery size of 15 to <18 mm in diameter generally pass through the gut and removal is rarely indicated for batteries beyond the esophagus[10]. On the contrary batteries of large size cannot enter the narrow orifices of external auditory canal and small diameter batteries can get impacted here and cause extensive damage. Various complications reported in the ear include: tympanic membrane perforation, total destruction or marked necrosis of dermis of the external auditory canal with exposed bone, hearing impairment, destruction of ossicles, facial nerve paralysis and chondritis.[1,5,7]

Various factors are implicated for the severity of the damage. An impacted button battery results in continuous exposure of localized tissue area to the damages caused by the battery. The delayed patient presentation prolongs the effect of button battery. Immersion of the battery in an electrolyte rich medium results in electrolysis and hydroxide production. This can occur by instillation of otic drops. Unfortunately otic drops can be prescribed as a reflexive therapy for painful and draining ear. A button battery is an absolute contraindication for the use of otic solution and mandates an adequate physical examination in all patients with otalgia and otorrhea[1,2,5,7].

The patient with button battery in external auditory canal usually presents with pain, ear discharge, sometimes mimicking malignant otitis externa or some complication like hearing loss or facial nerve paralysis. Radiographs of button batteries of all sizes have a distinctive double contour on radiographs. A high index of suspicion aided by radiographs help assist the diagnosis[1-3,5,6].

Button batteries in external auditory canal unlike gastrointestinal tract have a little chance of spontaneous passage hence it should be removed immediately. There is a risk of perforation of already corroded thin battery casing by a forceps. A 1 mm 90 ^{o} pick can be passed in the plane between the battery and the tympanic membrane, rotated to 90 ^{o} and used to pull the battery out of the canal. After removal of the battery the impaction site should be thoroughly irrigated to remove any precipitate and foreign material close follow up is indicated till healing occurs.[1,5,7]

Preventive measures in children include making the battery access difficult in all products available to the toddlers especially toys and watches. Further storage and replacement of batteries and disposal of discharged cell should be done to keep the batteries out of reach and view of children. The elderly hearing impaired patients must be cautioned against

inadvertent insertion of hearing aid batteries in the external auditory canal rather the hearing aid.[1-3,5,7]

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