**Button batteries: the worst case scenario in nasal foreign bodies**

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**Abstract**

**Aim** To present four cases of button battery nasal foreign bodies that were referred to an otolaryngology department over a 6-month period.

**Methods** Four cases are presented and discussed with a review of current literature.

**Results** Four children aged 2–4 years who were referred to an otolaryngology department over about 6 months were found to have a button battery in their nose. While there was mucosal damage in all the noses the likelihood of a septal perforation developing appears to be related to the time interval between insertion and removal. The two patients who did not develop a septal perforation had the battery removed after about 90 minutes and 3 days. The two patients who did develop a perforation had the battery removed after 4 hours and 24 hours. Battery thickness may also be important as the patient who had the battery removed at 3 days had a 2 mm thick battery whereas the other three all had a 5 mm thick battery.

**Discussion** As button batteries are ubiquitous it is imperative that consumers and medical practitioners are aware of the risks they pose if placed in the nose, and also elsewhere in the body.

**Conclusion** As early removal of a button battery is likely to decrease the chances of a septal perforation developing a nasal foreign body should be considered to be a button battery until proven otherwise.

A lot of initial assessment and investigation in general practice and the emergency department is based on worst case scenarios. A whiplash injury has cervical damage until proven otherwise, a headache with photophobia is meningitis, chest pain is a myocardial infarction, lower abdominal pain in a young woman is an ectopic pregnancy... the list goes on.

Nasal foreign bodies in children often present to both general practitioners and emergency physicians. These are usually innocuous with the majority being plastic objects (particularly beads), foam, paper or cotton.\(^1\) The button battery is the foreign body most likely to have serious sequelae if not removed quickly.\(^2,3\)

While button battery impaction in the nasal cavity is uncommon, four cases have been seen at the Otolaryngology Department at MidCentral District Health Board (DHB) in Palmerston North, New Zealand over a period of only 6 months.

We present these four cases and discuss the initial management of all children presenting with a nasal foreign body.
Case series

**Patient 1**—A 2-year-old female presented to the emergency department of a rural hospital 2 hours after her 4-year-old brother inserted a “metal wheel” up her left nostril.

Attempts to remove the object were unsuccessful and the patient was referred to the Otolaryngology Department at MidCentral Health for further management the following day.

When the object was removed under general anaesthesia (approximately 20 hours after insertion), the nasal cavity was found to be full of corrosive material and debris and the object was identified as a 5 mm thick 1.5V alkaline button battery (Figure 1; right side).

**Figure 1. Typical button batteries**

![Typical button batteries](image)

*Note:* Both batteries are 1.5V and are approximately 10 mm wide. The battery on the left is approximately 2 mm thick and is identical to the battery removed in Case 2. The battery on the right is approximately 5 mm thick and is identical to the batteries removed in the other three cases. The negative terminals are upright.

While we don’t know what is in the button batteries these four children put in their noses, we do know many contain zinc and silver oxide in a sodium or potassium hydroxide medium. Other types contain mercury, lithium, cadmium or sulphur. They are all in a metal casing and a plastic grommet forms the seal between the anode and cathode.⁴

The left nasal cavity mucosa was extensively damaged, with exposed blackened septal cartilage and burns superiorly and laterally along the medial border of the inferior turbinate. The contralateral septal mucosa was also extensively blackened although still intact.

At follow-up after 1 month, a septal perforation was evident despite treatment with antibiotics and saline/bicarbonate nasal douches.

**Patient 2**—A 4-year-old female presented to her general practitioner 3 days after inserting a button battery into her left nostril. The 2 mm thick 1.5V battery was removed under general anaesthetic. Burns were evident on the superior septum and the anterior portion of the inferior and middle turbinates (Figure 2). The mucosa on
the right side of the septum was intact. The nasal mucosa healed without any apparent permanent sequelae.

Figure 2. Patient 2’s intraoperative findings: charred areas are seen on septum and middle and inferior turbinates. The battery, similar to the one shown in figure 1 (left side), had been present for 72 hours.

Patient 3—A 4-year-old boy presented to the GP with what was thought to be a ball bearing up his nose. A 5 mm thick battery was removed approximately 4 hours after insertion under general anaesthetic. There was extensive damage to the nasal mucosa on the ipsilateral and contralateral sides of the septum. The surface of the battery was found to be heavily corroded (Figure 3; left-side battery).

Figure 3. 1.5V batteries removed from Patients 3 and 4 as compared to a new battery (right side) of the same size. The battery on the left side (Patient 3) had been in the nose for 4 hours. The middle battery (Patient 4) was removed after approximately 1.5 hours; corrosion is already clearly visible on the casing.
An asymptomatic septal perforation developed (Figure 4) which is being managed expectantly.

**Figure 4. View through septal perforation (Patient 3) from right nasal cavity to left nasal cavity**

**Patient 4**—A 4-year-old male had been playing with a 5 mm thick 1.5V button battery for 4 days before he put it into his right nasal cavity. The battery was removed after about 1.5 hours in Outpatients (Figure 3; middle battery). Blackening of the anterior portion of the right inferior turbinate and right septal mucosa was already present but the mucosa on the left side of the septum looked normal. There were no apparent long-term sequelae.

**Discussion**

A septal perforation has occurred in two of the four children in this case series; an incidence similar to that found in previous studies.\(^2\) The likelihood of a septal perforation is multifactorial.

Increased time interval between insertion and removal increases the risk of a septal perforation. Ongoing electrical and thermal burning will occur as long as the electrical circuit is intact and, as the length of time increases, the chemicals released by erosion of the metal shell of the battery may also contribute to further morbidity.

The thickness of the battery may be important, as suggested by the case of the only patient who had a thinner (2 mm rather than 5 mm) battery in their nose—this patient didn’t develop a septal perforation even though the battery was in place for 3 days. Of course the charge of the battery is likely to be important too and this may have been the only flat (dead) battery.

The orientation of the battery in the nasal cavity is also reported to be important, with tissue at the anode pole (negative) more likely to be damaged.\(^2\) Hence if the anode pole is against the septum, a perforation is more likely. The size of the nose and the amount of secretions in the nose may also be factors.
Damage to the nasal mucosa has previously been reported after as few as 3 hours, with damage leading to perforation after 7 hours.\textsuperscript{2,5}

This case series shows that mucosal damage can occur as early as 90 minutes, and sufficient mucosal damage to later cause a septal perforation can occur after a time interval of only 4 hours.

Mucosal damage is due to several mechanisms. Firstly, the electrical circuit is completed because the battery is in contact with both sides of the nasal cavity, and the high ionic concentration of the nasal secretions is thought to generate local currents that cause electrical and thermal burns.\textsuperscript{2,6,7}

Secondly, erosion of the plastic seal and the layer separating the anode and cathode mixtures results in leakage of battery contents causing chemical burns, particularly at the anode (negative) side.\textsuperscript{2} See Figure 5. The battery may also cause pressure necrosis although this is unlikely to play a significant role.\textsuperscript{2,6,7}

**Figure 5. Cross section schematic of a button battery**

![Cross section schematic of a button battery](image)

Until the advent of button batteries, nasal foreign bodies were generally not considered to be an emergency, with the main concern being the possibility of aspiration if the foreign body went right through the nose.

In practice, most foreign bodies don’t go through the nose and if they do they are usually swallowed rather than aspirated. Many nasal foreign bodies present late with a unilateral foul-smelling discharge which ceases when the foreign body is removed.

Button batteries are different in that they almost immediately start to cause tissue destruction that may cause a septal perforation with possible later sequelae such as an effect on the growth of the nose.

While button batteries in the nose are not common they must be considered in order to be excluded. Indeed in a recent review by Glynn (who presented a case series of three button batteries) none were diagnosed prior to removal under general anaesthetic.\textsuperscript{8} While Glynn advocates the use of a plain film skull X-ray in the diagnosis of every child presenting with a nasal foreign body, and Lin et al have demonstrated the distinct double contour on plain films that aids in correct diagnosis,\textsuperscript{7} we believe an
X-ray will only be appropriate occasionally. Usually the nature of a foreign body is apparent from the history and examination, and after you have seen a few nasal button batteries the copious secretions immediately ring alarm bells.

An X-ray would appear to be worthwhile only if the positive finding of a battery will expedite access to the operating room. General anaesthesia is usually required, although in the 4-year-old in whom the battery had only been present for 90 minutes this was able to be removed in outpatients, presumably because not enough erosion had yet taken place to make it adherent to the tissues.

It is our impression—both from the parental behaviour in some of these cases and talking to friends, medical colleagues, and nurses—that there is very little community awareness of the risks these batteries pose to young children. We hope therefore that this paper will raise both community and medical awareness.

Conclusions

Management begins with a thorough history; reliable witness accounts should be married with a thorough examination of the anterior nasal cavity.

Time in the nose is important. Removal at 90 minutes is likely to mean no permanent sequelae whereas removal at 4 hours can mean a septal perforation. If a nasal foreign body could be a button battery then urgent referral to an otolaryngologist is indicated. A nasal foreign body should be considered to be a button battery until proven otherwise.

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References: