CASE REPORT

Inhalation of a plastic wall plug: implications of foreign body characteristics in paediatric patients

Nora Haloob, Peter Loizou, Marie Lyons

Department of ENT, Lister Hospital, Stevenage, UK

Correspondence to
Nora Haloob,
nora.haloob@nhs.net

SUMMARY

Foreign body inhalation causing asphyxiation is a significant cause of death in children under 4 years. Approximately one-fifth of the cases are inorganic industrial objects. We describe the case of an 18-month-old boy who presented with respiratory distress after inhaling a wall plug. An emergency rigid bronchoscopy was performed; however, the nature of the object and its location within the airway proved it difficult to identify at first look, causing the removal to be a challenge even in the most skilled of hands. Furthermore, its design contributed to the severity of obstruction of the airway and hence risk of death. This case prompts a discussion on the safety implications of small inorganic product designs and the measures currently being taken by manufacturers and clinicians to prevent the fatal asphyxiation in children.

BACKGROUND

Accidental foreign body inhalation causing asphyxiation is attributed to 7% of deaths in children under 4 years in the USA.¹ Between 2008 and 2009, there were a little over 300 hospital admissions with foreign body inhalation in children under 14 in England.² It is an emergency scenario dreaded by most, if not all, otolaryngologists, yet inevitable during most of our careers. The nature of the inhaled object in this case made it a challenge to even our most experienced paediatric bronchoscopist and therefore is worth sharing with the ear, nose and throat (ENT), paediatric and emergency communities.

This article will be of interest not only to clinicians, but also to the general public, to highlight the importance of child safety in small inorganic object product designs as a public health concern.

CASE PRESENTATION

An 18-month-old boy was blue-lighted to the Lister Hospital Emergency Department with a history of sudden onset respiratory distress and aphonia, due to a suspected foreign body inhalation. Pulse oximetry on air recorded 86%, with improvement to 92% on high flow oxygen via a non-rebreather mask. He was severely tachypnoeic and showed signs of subcostal and sternal recession. The patient was accompanied by his parents, who suspected the possible inhalation of a plastic wall plug. The colour of the plug was not ascertained at the time.

TREATMENT

Aside from bedside monitoring, no investigations were performed as the patient swiftly underwent

rigid bronchoscopy under gas sedation in the theatre. The stack system was used for magnified visualisation. A size 4 mm bronchoscope was passed into the trachea; initially no distinct foreign body could be seen. On inspection, the mucosa appeared to have a red coloured, inflamed appearance. It was thought that this could be an inflammatory reaction to the trauma of a passing foreign body. At this stage, the bronchoscopist had not encountered any resistance and was preparing to advance the scope, assuming that the object was in the distal airway. During the bronchoscopy, it was noticed by the first author, an ENT CT1 on call at the time with no prior experience in paediatric bronchoscopy, that the presumed inflamed mucosa was in fact the foreign body. The wall plug was lying in its vertical axis within the trachea. Its cylindrical shape and red colour mimicked the endothelial lining of the trachea, creating a camouflage effect. The first author alerted the consultant performing the procedure, who managed to deliver the foreign body successfully with minimal trauma under direct vision using a laryngoscope and forceps, as the bronchoscope was not of the appropriate size for removal of the object.

OUTCOME AND FOLLOW-UP

The patient made an excellent recovery and was discharged the following day.

DISCUSSION

This case highlighted a number of issues on reflection. Had the foreign body not been identified at that time, the operating surgeon may have proceeded to continue distal examination of the trachea in search of the foreign body and potentially pushed it further down the tracheobronchial tree. This may have caused catastrophic consequences.

This led us to discuss the potential implications of inhalation of this type of wall plug. On closer inspection of the plug, it had a number of slits on either side of the body; owing to the critical nature of the patient's presentation, a photograph of the wall plug was not taken at that time, however, a similar image is shown to illustrate this (figure 1). It did not however have a hole at the distal tip of the plug. Therefore, it was assumed that the patient was maintaining his saturations through the sides of the plug rather than a continual passage through the centre of the plug. Interestingly, we reviewed a number of wall plugs in a well-known DIY store. Several are designed with a hole at the tip, however, none were found to have any safety

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Figure 1 Example of wall plug implicated in this case.

warnings on the packaging of wall plugs relating to handling by children below a certain age.

The potential risks involved with inorganic object inhalation have prompted international multicentre investigation aiming to reduce these risks. The European Survey of Foreign Body Injuries (ESFBI) study began collecting data in 2004 from 19 hospitals, each from different European countries (including the UK), of all foreign body inhalation admissions.³ The epidemiological data collected resulted in the inception of a European surveillance register for injuries due to non-food foreign body inhalation and inception of the 'SUSY SAFE project'. The aim of this campaign is to provide a risk-analysis profile for each product. Their data so far have highlighted that three-dimensional spherical and cylindrical structures, particularly those with a diameter of 31 mm, pose the highest risk to the paediatric patient.⁴ It recommends that passive environmental strategies such as product modification by manufacturers would be the most effective, as a large proportion occurred under adult supervision. However, we argue that inhalation of inorganic foreign objects are less likely to be witnessed than food objects (as it is the child who places the object in his mouth) and therefore pose a greater risk of delayed detection, potentially leading to greater morbidity and mortality.⁵

The most widely recognised adaptation of product design due to the potential implications of inhalation is the BIC pen lid. It was adapted in 1991 to include an open-ended lid to allow the passage of air should a child accidentally inhale the pen cap. This would potentially minimise the risk of suffocation and was adapted to comply with the international safety standards. These standards require that pen caps be ventilated to permit a minimum airflow of 8 L/min, at room temperature, with a maximum pressure difference of 1.33 kPa.⁶

We propose that the same be implemented for certain wall plugs that do not have an open-ended tip, as in this case. We are currently in the process of advising manufacturers of wall plugs to look into their choice of colouring for products like wall plugs and the printing of safety warnings on their packaging. We also support the work of the SUSY SAFE working group to increase the manufacturer and consumer awareness of the potential risks of small inorganic products to children. We have registered this case on their database, and we encourage all clinicians who encounter foreign body inhalation in children under 14 to do the same and to participate in their campaign.

Learning points

- ▶ Foreign body asphyxiation is a significant cause of death in children under 4.
- ▶ One-fifth of cases are caused by inorganic industrial objects.
- ▶ Safety considerations in product design are crucial to preventing death.
- ▶ Cylindrical, closed-end, red coloured objects less than 31 mm in diameter are particularly high risk, as demonstrated in this case.
- ▶ The European Survey of Foreign Body Injuries (ESFBI) and the SUSY SAFE project aim to reduce the Europe-wide incidence.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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