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Case Report

Small magnet aspiration as a pediatric emergency: a case report

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Abstract: Tracheobronchial airway foreign body aspiration (FBA) in children is a common and serious pediatric medical emergency. With the increasing use of small magnets in home offices, in toys and the kitchen, inhalation of small magnets has become an increasing risk to children. We present a case of a 9-year-old boy who presented with cough and dyspnea three days following inhalation of an 3 cm-sized oval magnet. The history and the chest radiograph were important in planning for the removal of the aspirated foreign body. In this case, we removed the inhaled magnet using rigid bronchoscopy under general anesthetic. We herein reviewed the recent reports on the incidence and management of small foreign body aspiration as a pediatric emergency.

Keywords: Foreign body aspiration, small magnet, airway, bronchoscopy, pediatric emergency

Introduction

Tracheobronchial airway foreign body aspiration (FBA) in children is a common and serious pediatric medical emergency [1]. In the U.S. in 2000, foreign body aspiration or ingestion was responsible for more than 17,000 emergency department visits in children younger than 14 years of age; 80% of children were younger than 3-years-old, with a peak incidence between 1 and 2 years of age [2, 3]. Death due to suffocation following foreign body aspiration is the leading cause of unintentional injury-related mortality in children under the age of one year in the U.S. [4].

Analysis of aspirated foreign bodies in children shows that between 67% and 87.12% are of organic origin and include, for example, peanuts and beans [5-7]. Inhaled inorganic objects are less common than organic ones [5-7]. However, there is a certain type of object, the small or 'button' magnet that has become an increasing problem in the pediatric emergency department [8-11].

In 2012, Foltran and colleagues reviewed 1,063 published papers on airway foreign body inhalation and found that almost 20% of children who have inhaled foreign bodies were less than 3 years of age [8]. Delayed diagnosis of an inhaled foreign body resulted in serious acute and chronic complications, which occurred in almost 15% of patients. Among inorganic inhaled foreign bodies, the greatest pooled proportion was recorded for magnets (13 reported cases) [8].

The recent popularity for having offices in family homes that contain magnetic boards, the use of small magnets in modern toys and games, and the increasing use of small fridge magnets, all contribute to this new danger to children [9, 10]. There is also a fascination for children in using small magnets to mimic 'piercings' of the tongue, nose, and lips [9, 10].

In 2013, Silverman and colleagues reported this increase in pediatric magnet-related foreign bodies presenting to the emergency department in the U.S. [11]. In an analysis of 22,581 magnet-associated foreign body cases during a 10-year period; 74% were ingested; 21% were intranasal, and the rest were inhaled [11]. The mean age for ingested magnetic foreign bodies presenting as emergencies was 5.2 years; the mean age for nasal magnetic foreign bodies was 10.1 years [11]. The incidence of

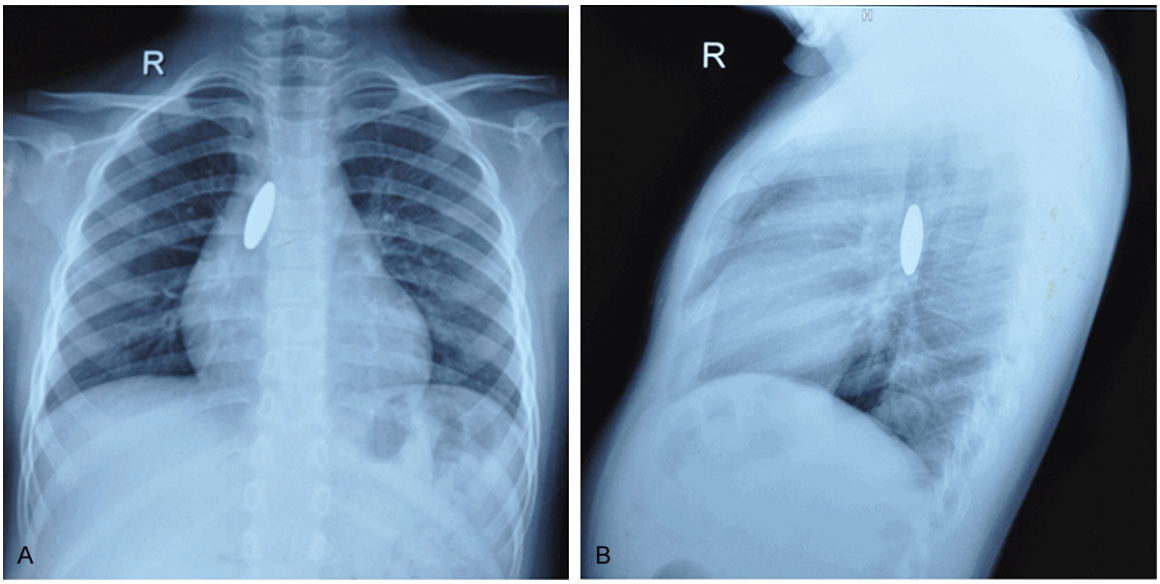

Figure 1. Anterior-posterior (A) and lateral-posterior (B) chest radiograph showed a radio-opaque shadow of ovoid FB in the right major bronchus.

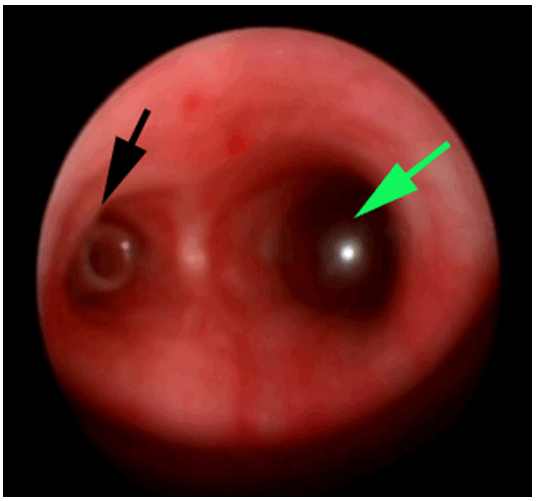

Figure 2. At bronchoscopy the foreign body is seen in the right bronchus (green arrow) and the 'protective' catheter is seen in the left bronchus (black arrow).

pediatric magnet ingestions increased from 0.57 cases per 100,000 children per year in 2002 to 3.06 cases per 100,000 children per year in 2011 [11].

It is only recently that the medical dangers of these small magnets have been recognized, but few preventive or management guidelines exist and some parents and health workers may still be unaware of the pediatric dangers of small magnets [12, 13].

We present a recent case from our department to illustrate the problem of detection and extraction of an aspirated small magnet in a 9-year-old boy. We have previously published a short version of this case in the Chinese language [14]. In this revised case report, we include a discussion on the approach to removal of this type of inhaled foreign body and the reasons for further investigations. Some of the recent U.S. public health recommendations on the hazards of small magnets are discussed as we feel that this case illustrates an important and growing pediatric public health concern [10, 11, 13].

Case report

A previously healthy 9-year-old boy developed a persistent cough and increasing respiratory distress three days before admission to our clinic. When asked, he remembered that he had inhaled a 'wall magnet' at home. At the time, he had coughed and thought he had coughed it up.

In the clinic, a chest X-ray was performed. The anterior and lateral chest radiographs showed an oval, radio-opaque shadow in the right main bronchus (**Figure 1**). The boy was admitted from the clinic to the department of otorhinolaryngology. On admission, he had a temperature of 37.3°C, respiration rate of 25 breaths/min, a

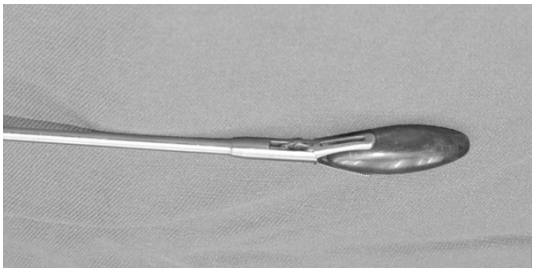

Figure 3. The forceps used to extract the small magnet; these are usually used to extract foreign bodies from the esophagus.

pulse rate of 105 beats/min, and blood pressure of 108/62 mmHg. He was in mild respiratory distress, but his oxygen saturation was 100% on inhaling of room air. Auscultation over the right hemithorax detected reduced breath sounds.

Using a similar magnet provided by the parents, we tested which kind forceps we should use to attempt to retrieve the foreign body and the amount of force that we should use to do so. Following consultation with the thoracic surgeon, extracted with bronchoscopy was performed the next day under general anesthesia. We used a rigid 7.1 mm (internal diameter) × 300 mm (length) pediatric bronchoscope (STORZ Medical AG). We reserved the option of using thoracotomy had this method failed. We were also prepared to undertake a tracheotomy in case the foreign body became caught in the subglottis or vocal cords.

During the bronchoscopy, the position we chose for the patient was head-down at 30 degrees to prevent the foreign body falling into the left bronchus. We noted that the trachea and left bronchus were normal. A French 6-guage catheter was cut into a 5 cm length and placed in the left main bronchus to prevent the foreign body from falling in (**Figure 2**). The inhaled small oval magnet was extracted using forceps (**Figure 3**). The foreign body extraction was performed under bronchoscopic visualization. On removal, the foreign body was confirmed to be a small, oval magnet, measuring 3 cm in length and 0.9 cm in diameter.

Air entry to the right lung improved immediately after removal of the foreign body. The patient recovered well and was discharged home on the following day.

Discussion

Foreign body aspiration can occur in every age group but occurs more commonly in children between the ages of 2- and 5-years-old [7]. There is a variety of organic and inorganic inhaled foreign bodies that have been described in the pediatric age group [1, 5-8].

As our case report illustrates, the history, given by the child, parent or other witnesses are very important as this may identify the object and assist in the preparation for its removal [16]. Although some of the organic inhaled foreign bodies may not be detected on plain chest radiography, we found that in this case the chest X-ray was very important in guiding treatment and confirming the identity of the foreign body [16, 17].

Aspirated foreign bodies commonly lodge in the right bronchial system [5]. The methods of foreign body removal include rigid bronchoscopy, tracheotomy and thoracotomy [5, 18]. The foreign body may be extracted by grasping forceps, catheters, extraction baskets, or by a metal or magnetic probe [5, 18, 19]. In this case, we were able to remove the oval magnet using bronchoscopy and grasping forceps.

Thoracotomy is reserved as a last resort due to the inherent risks of the procedure [19, 20]. Indications for the use of thoracotomy include inability of the foreign body to pass through the glottis, when it is sharp, when it cannot be reached by bronchoscopy or when the foreign body has adhered to or penetrated bronchial tissue [20].

Although magnet inhalation is uncommon, it has been increasingly described in the pediatric age group [8-11]. When more than one magnet is ingested, the child may suffer from bowel obstruction due to loops of the bowel becoming attached as the magnets attract [10, 13]. Therefore, it is important to exclude the possibility of ingested magnets, with an abdominal X-ray, when a child presents as an emergency having inhaled a magnet [10].

In 2013, the American Academy of Pediatrics (AAP) published its advocacy document regarding the dangers of ingesting and inhaling of small magnets [13]. The advice given by the AAP to pediatricians included informing parents

regarding magnet safety and advising the federal Consumer Product Safety Commission (CPSC) regarding unsafe toys, appliances or practices that used magnets [13, 21]. In 2012, the CPSC produced its ruling on Safety Standards for Magnet Sets (CPSC-2012-0050) [21].

Magnet-related injuries and emergencies are now a recognized pediatric public health problem [11-13]. Older children may use magnets for play or to imitate tongue, nose, lip or other piercings. Because magnet ingestion is more common than magnet inhalation, we would advise that any child who presents to the emergency department with magnet inhalation should also have an abdominal X-ray. Increasing awareness among medical staff and parents of the dangers of magnets and the implementation of improved magnet safety standards may decrease the increasing risk that small magnets pose to children.

Disclosure of conflict of interest

None.

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References

[1] Passàli D, Lauriello M, Bellussi L, Passali GC, Passali FM, Gregori D. Foreign body inhalation in children: an update. Acta Otorhinolaryngol Ital 2010; 30: 27-32.

[2] Zhu J, Shen YY, Zhao YQ, Lin R, Fang F. A case of spontaneous tubal pregnancy with caesarean scar pregnancy. Int J Clin Exp Med 2014; 7: 2941-2944.

[3] National Safety Council. Report on Injuries in America, 2002. Information online: http://www.nsc.org/learn/safety-knowledge/Pages/injury-facts.aspx. Accessed on April 16, 2015.

[4] WISQARS Leading causes of death reports, 1999-2001. National Center for Injury Prevention and Control. Information online: http://webappa.cdc.gov/sasweb/ncipc/leadcaus10.html. Accessed on April 16, 2015.

[5] Mantel K, Butenandt I. Tracheobronchial foreign body aspiration in childhood: A report on 224 cases. Eur J Pediatr 1986; 145: 211-216.

[6] McGuirt WF, Holmes KD, Feehs R, Browne JD. Tracheobronchial foreign bodies. Laryngoscope 1988; 98: 615-618.

[7] Tan HK, Brown K, McGill T, Kenna MA, Lund DP, Healy GB. Airway foreign bodies (FB): A 10-year review. Int J Pediatr Otorhinolaryngol 2000; 56: 91.

[8] Foltran F, Ballali S, Passali FM, Kern E, Morra B, Passali GC, Berchialla P, Lauriello M, Gregori D. Foreign bodies in the airways: A meta-analysis of published papers. Int J Pediatr Otorhinolaryngol 2012; 76: S12-19.

[9] Suk-Koo L, Nam-seon B, Hyun-Hahk K. Mischievous magnets: Unexpected health hazard in children. J Pediatr Surg 1996; 31: 1694-1695.

[10] McCormick S, Brennan P, Yassa J, Shawis R. Children and mini-magnets: an almost fatal attraction. Emerg Med J 2002; 19: 71-73.

[11] Silverman JA, Brown JC, Willis MM, Ebel BE. Increase in Pediatric Magnet-Related Foreign Bodies Requiring Emergency Care. Ann Emerg Med 2013; 62: 604-608.

[12] Committee on Injury, Violence, and Poison Prevention. Prevention of choking among children. Pediatrics 2010; 125: 601.

[13] American Academy of Pediatrics (AAP). AAP Alerts Pediatricians to Dangers of Magnet Ingestions. Information online: https://www.aap.org/en-us/advocacy-and-policy/federal-advocacy/Pages/AAP-Alerts-Pediatricians-to-Dangers-of-Magnet-Ingestions.aspx. Accessed on April 16, 2015.

[14] Ke KJ, Liu DB, Huang ZY, Xu JJ. One case of rare tracheobronchial foreign body (fusiform magnet) successfully removed through bronchoscopy in a child. Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi 2013; 48: 848.

[15] Karatzanis AD, Vardouniotis A, Moschandreas J, Prokopakis EP, Michailidou E, Papadakis C, Kyrmjzakis DE, Bizakis J, Velegrakis GA. The risk of foreign body aspiration in children can be reduced with proper education of the general population. Int J Pediatr Otorhinolaryngol 2007; 71: 311-315.

[16] Tokar B, Ozkan R, Ilhan H. Tracheobronchial foreign bodies in children: Importance of accurate history and plain chest radiography in delayed presentation. Clin Radiol 2004; 59: 609.

[17] Mortellaro VE, Iqbal C, Fu R, Curtis H, Fike FB, St Peter SD. Predictors of radiolucent foreign body aspiration. J Pediatr Surg 2013; 48: 1867-1870.

[18] Ramirez-Figueroa JL, Gochicoa-Rangel LG, Ramirez-San Juan DH, Vargas MH. Foreign body removal by flexible fiberoptic bronchoscopy in infants and children. Pediatr Pulmonol 2005; 40: 392-397.

[19] Zhijun C, Fugao Z, Niankai Z, Jingjing C. Therapeutic experience from 1428 patients with pediatric tracheobronchial foreign body. J Paediatr Surg 2008; 43: 718-721.
[20] Marks SC, Marsh BR, Dudgeon DL. Indications for open surgical removal of airway foreign bodies. Ann Otol Rhinol Laryngol 1993; 102: 690-694.
[21] Safety Standards for Magnet Sets (CPSC-2012-0050). 3 Sep 2014. Final Rule: Consumer Product Safety Commission. Available online: http://www.cpsc.gov/Global/Newsroom/FOIA/CommissionBriefingPackages/2014/SafetyStandardforMagnetSets-FinalRule.pdf. Accessed on April 16, 2015.