

CHAPTER 52

AERODIGESTIVE FOREIGN BODIES IN CHILDREN

Neetu Kumar
Ashish Minocha

With minor contributions by
David Msuya

Introduction

Aerodigestive foreign bodies are common causes of morbidity and mortality in infants and children worldwide. It is difficult to eradicate the problem, as children, by nature, are curious and exploratory. Possibly the only difference from one country to another is in the nature of foreign bodies commonly encountered. It is important to develop a comprehensive approach to the early recognition and timely management of aspirated and ingested foreign bodies, as complications from delayed diagnosis can have significant health implications. Serious complications from aspirated foreign bodies such as severe airway obstruction and death, tend to occur in infants and younger children due to the small size of their airways.

Chevalier Jackson's initial description of endoscopic removal of foreign bodies in 1936¹ revolutionised the treatment options for management of aerodigestive foreign bodies.² Associated developments in radiology have played an important role in the rationalised and safe management of these cases.

Epidemiology

Foreign body ingestion and aspiration are common childhood adverse events. They form the third leading cause of death in children under the age of 1 year and the fourth leading cause in the age group 1–6 years. The maximum prevalence is seen between the ages of 1 and 2 years; however, no age group is completely immune.^{3–5}

Children younger than 5 years of age represent the highest risk group. This risk is increased if the child has neurological impairment.⁶ Unfortunately, these children are often not viewed with a high index of suspicion when they present with nonspecific symptoms. Children known to have congenital anatomic or physiologic abnormalities of the oesophagus, such as diffuse oesophageal spasm, oesophageal atresia, and/or tracheo-oesophageal fistulas, or those who had previous bowel surgery are at increased risk of complications.

The commonly encountered foreign bodies vary geographically. Coin ingestion seems to be the commonest worldwide problem.⁷ Other common nonfood items are school stationery, balloons, and toys. Pharyngeal fish bones are well reported from countries where fish forms a part of the staple diet. Over the years, there has been a rise in the incidence of disk-type battery ingestion in the paediatric population, which can lead to serious consequences.⁸

Seeds and nuts are frequent causes of tracheobronchial obstruction worldwide. Accidental aspiration of peanuts is commonly responsible for airway obstruction in children in Southeast Asia and Africa, and kola nuts, which are traditionally used in Africa, may be inhaled accidentally.

Clinical Presentation

Children present in myriad fashions, both with typical and not so typical or convincing stories. The problem is worse when no witness is available or parents are unsure of the sequence of events. In addition,

older children may be reluctant to divulge the initial details for fear of punishment or due to embarrassment. Such enquiries should therefore be made discreetly and tactfully.

Tracheobronchial foreign bodies typically present with shortness of breath, wheezing, stridor, cough without associated illness, recurrent or migratory pneumonias, and even acute aphonia. When the diagnosis is initially missed, children often present with recurrent respiratory tract infections (pneumonia, empyema, and abscess formation).

Oesophageal foreign bodies typically present with odynophagia, drooling, spitting, vomiting, or even secondary airway compromise from foreign body impingement. Episodic vomiting may be the only presentation in some cases.⁹

Pathophysiology

Certain characteristics can predispose children to the likelihood of an aerodigestive mishap. Their underdeveloped posterior dentition, along with their immature swallowing mechanism, is no match for their oro-exploratory behaviour.

The process of aspiration or ingestion of foreign bodies can present in three different stages.¹⁰ The first (or acute) stage characteristically involves a phase of coughing, choking, and gagging. This history is often easily elicited. Typically, an asymptomatic period follows the first phase. The diagnosis is potentially missed if the patient presents during this time. The third phase is a period of chronicity characterised by failure to thrive, recurrent lung infestations, wheeze, dysphagia, or even more severe manifestations such as intrathoracic abscesses and vascular catastrophes secondary to foreign body fistulation.¹¹

Investigations

Nothing can substitute for a high index of clinical suspicion. However, clinicians must understand the role and limitations of emergency radiography. Plain radiographs should be assessed in two dimensions.^{12,13} Radio-opaque foreign bodies are often easily seen, but more important is accurate anatomical localisation to assist retrieval. Follow-up radiographs are often essential if the preliminary studies have been negative. If a foreign body has not been visualised in the cervical or thoracic regions, it may well have passed into the small and large bowel; such relevant body parts may also need imaging. At times, there are indirect signs that assist in making a diagnosis. For example, air trapping on expiratory chest radiographs may be indicative of an obstructing foreign body not otherwise visible. In a considerable number of cases, plain radiography is unrevealing and secondary signs are not convincing enough to make a confirmed diagnosis. Some children may need urgent fluoroscopy to look for "filling defects" in the digestive tract.¹⁴

Bronchoscopy can be both diagnostic and therapeutic. Foreign bodies more distally located in the respiratory tree may warrant an urgent bronchogram. Computed tomography (CT) and even magnetic resonance imaging (MRI) may be employed to detect foreign bodies

that are not found during endoscopic examination or if migration from the airway or oesophagus is suspected.¹⁵

Management

“Prevention is better than cure”—this proverb holds utmost conviction when it comes to aerodigestive foreign bodies in children. Public awareness and education are key elements to help foster a culture of preventive medicine.

In the emergent situation, paediatric life-support algorithms should be employed in a conscious child presenting with known foreign body airway obstruction. This involves voluntary coughing in older children and back blows between the shoulder blades in infants to dislodge the impacted foreign body. Crucial steps in acute management are the ABCs: optimisation of **A**irway, **B**reathing, and **C**irculation.

For both tracheobronchial and oesophageal foreign bodies, the definitive and safest treatment option is endoscopic retrieval under general anaesthesia. In a few cases, however, a more proximal foreign body may be removed under local anaesthesia. Risks and complications (aspiration) due to accidental dislodgement must be carefully considered before such an undertaking, though.

Some centres have reported success in the retrieval of smooth foreign bodies of the airway by using guide wire and angioplasty catheters.¹⁶ The successful use of a Foley catheter with balloon inflation, with or without fluoroscopic guidance, to retrieve an oesophageal foreign body such as a coin, has been reported in older literature and is still practiced successfully with minimal morbidity in countries where endoscopic facilities may not be readily available.

Timing of an endoscopy is crucial. It may be required urgently in the following situations: (1) any suggestion of airway compromise, (2) a history of aspiration of dried peas or beans because they have a hygroscopic potential to swell up and block distal airways, (3) batteries impacted in the oesophagus because they can cause early caustic mucosal damage and even perforation, and (4) any suggestions of oesophageal perforation.^{17,18}

The success of intervention depends on the experience and skill of the endoscopist and the local availability of the optimal instruments. The bronchoscope or oesophagoscope should be carefully sized to the predicted size of the child’s airway/oesophagus and the foreign body.

Foreign bodies impacted in the pharynx/upper airway are usually visible during intubation and may be taken out by an anaesthetist using a Magill’s forceps.

A rigid bronchoscope can be successfully used for removal of foreign bodies from the trachea or one of the main bronchi. Once the foreign body is localised, appropriate suction is introduced and grasping forceps help to engage the body. The endoscope is advanced to cover the object completely. The endoscope, forceps, and foreign body are then removed simultaneously. Good anaesthetic support is a must for success.¹⁹ More distal foreign bodies need retrieval by flexible bronchoscopy.

Oesophageal foreign bodies are best retrieved by rigid oesophagoscopy. The same principles as for a flexible bronchoscopy apply. Occasionally, if the retrieval looks challenging and the type of foreign body is definitely known to be inert, it may be pushed further into the stomach. This avoids the risks of aspiration and dislodgement. Nature can then be allowed to take its course. Disk batteries stuck in the oesophagus could cause serious harm and should be retrieved endoscopically as a matter of urgency.

Foreign bodies in the stomach and bowel usually do not need taking out unless they are harmful (e.g., sharp objects, batteries that have shown no progression beyond the stomach over a 48-hour period, or toxic foreign bodies). Long foreign bodies (>6 cm), such as tooth brushes and pens, and wide foreign bodies (> 2 cm), such as some toys, are also likely to remain stuck in the stomach. Ingestion of more than one magnet has been reported to cause necrosis of the intestine trapped

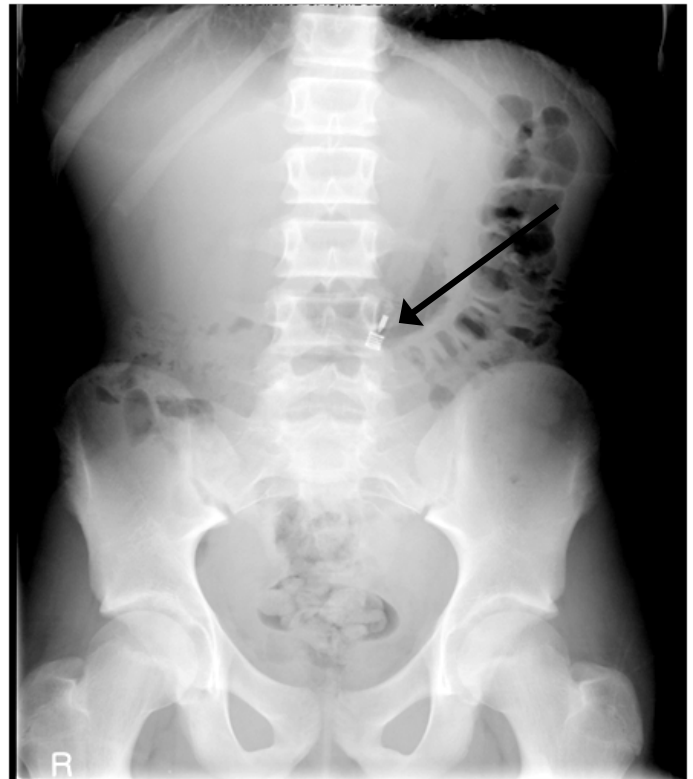


Figure 52.1: A retained pen in the stomach. There was no change in the position of the foreign body on a chest radiograph, 10 days after accidental ingestion.



Figure 52.2: The protective sheath through which the different sizes of endoscopes can be easily guided. Preplacement of the protective sheath protects the oesophagus from accidental damage during retrieval of a sharp or pointed object.

between the two magnets;²⁰ therefore, it may be advisable to retrieve the magnets while they are still accessible in the oesophagus or stomach.

When the ingested foreign bodies are not retrieved, patients and parents are advised to look for foreign bodies in the stool. If not egested in a week to 10 days, repeat check x-rays are taken, and if no further distal movement of the foreign body is demonstrated beyond the stomach (see Figure 52.1), it is best retrieved endoscopically. Laparoscopic, or laparotomy-assisted, retrieval may be indicated very rarely, except for the situation of a secondary complication of obstruction or perforation. One reason to attempt a proactive laparoscopic or laparotomy retrieval is the risk of a secondary complication outweighing the chances of spontaneous passage of the foreign body.

Most of the endoscopic interventions are done as day procedures. Postinterventional care is straightforward and should be tailored to the specific need. Antibiotics are administered only if complications are suspected.

Practical Hints and Tips

The endoscopist must be aware of the following situations:

1. There may be more than one foreign body. This situation is more common and relevant with tracheobronchial foreign bodies such as aspirated food items, nuts, and seeds. Therefore, a thorough assessment of the airway is important.
2. The suction device “tip” should not be used to remove the object because it is not strong enough to hold the object during transit to the external world.
3. The dangerous end of sharp foreign bodies should be carefully covered by the scope (in case of a rigid scope) or a flexible endoscope protective sheath prior to removal (Figure 52.2).
4. Good haemostasis should be maintained.
5. Repeat inspection of the airway or digestive tract for any evidence of secondary or iatrogenic injury once the foreign body is retrieved.

Key Summary Points

1. Inhalation or ingestion of a foreign body by a child is a common accident that may cause significant morbidity or even mortality.
2. The situation worsens when the foreign bodies are initially missed and then later the patient presents with pneumonia, atelectasis, abscess, or bleeds.
3. Radiography, fluoroscopy, bronchogram, CT, and MRI have all been used to make a confirmatory diagnosis.
4. Of utmost importance are a good history and clinical suspicion.
5. The treatment of choice remains endoscopic retrieval under general anaesthesia.
6. Success is ensured by careful assessment of the airways or oesophagus as well as foreign body size and shape prior to skilled endoscopy retrieval.²¹

References

1. Jackson C, Jackson, CL. Diseases of the Air and Food Passages of Foreign Body Origin. Saunders, 1936.
2. Boyd AD. Chevalier Jackson: the father of American bronchoesophagoscopy. *Ann Thorac Surg* 1994; 57(2):502–505.
3. Steen KH, Zimmermann T. Tracheobronchial aspiration of foreign bodies in children: a study of 94 cases. *Laryngoscope* 1990; 100(5):525–530.
4. Mu L, He P, Sun D. Inhalations of foreign bodies in Chinese children: a review of 400 cases. *Laryngoscope* 1991; 101:657–660.
5. Diaz GA, Valledor L, Seda F. Foreign bodies from the upper-aerodigestive tract of children in Puerto Rico. *Bol Asoc Med PR* 2000; 92(9–12):124–129.
6. DeRowe A, Massick D, Beste DJ. Clinical characteristics of aerodigestive foreign bodies in neurologically impaired children. *Int J Pediatr Otorhinolaryngol* 2002; 62(3):243–238.
7. Mahafza TM. Extracting coins from the upper end of the esophagus using a Magill forceps technique. *Int J Pediatr Otorhinolaryngol* 2002; 62(1):37–39.
8. Higo R, Matsumoto Y, Ichimura K, Kaga K. Foreign bodies in the aerodigestive tract in pediatric patients. *Auris Nasus Larynx* 2003; 30(4):397–401.
9. Messner AH. Pitfalls in the diagnosis of aerodigestive tract foreign bodies. *Clin Pediatr (Phila)* 1998; 37(6):359–365.
10. Tan HKK, Brown K, McGill T, et al. Airway foreign bodies (FB): a 10-year review. *Intl J Pediatr Otorhinolaryngol* 2000; 56(2):91–99.
11. Remsen K, Lawson W, Biller HF, Som ML. Unusual presentations of penetrating foreign bodies of the upper aerodigestive tract. *Ann Otol Rhinol Laryngol Suppl* 1983; 105:32–44.
12. Herdman RC, Saeed SR, Hinton EA. The lateral soft tissue neck x-ray in accident and emergency medicine. *Arch Emerg Med* 1992; 9(2):149–156.
13. Lue AJ, Fang WD, Manolidis S. Use of plain radiography and computed tomography to identify fish bone foreign bodies. *Otolaryngol Head Neck Surg* 2000; 123(4):435–438.
14. Koempel JA, Hollinger LD. Foreign bodies of the upper aerodigestive tract. *Ind J Pediatr* 1997; 64(6):763–769.
15. Sethi DS, Stanley RF. Migrating foreign bodies in the upper digestive tract. *Ann Acad Med Singapore* 1992; 21(3):390–393.
16. Briggs G, Walker RWM. Retrieval of an endobronchial foreign body using a guide wire and angioplasty catheter. *Anaesthesia and Intensive Care* 2007; 35(3):433–436.
17. Ginsberg GG. Management of ingested foreign objects and food bolus impactions. *Gastrointest Endosc* 1995; 41:33–38.
18. Friedman EM. Tracheobronchial foreign bodies. *Otolaryngol Clin North Am* 2000; 33(1):179–185.
19. Swanson KL, Edell ES. Tracheobronchial foreign bodies. *Chest Surg Clin N Am* 2001; 11(4):861–872.
20. Vijaysadan V, Perez M, Kuo D. Revisiting swallowed troubles: intestinal complications caused by two magnets—a case report, review and proposed revision to the algorithm for the management of foreign body ingestion. *J Am Board Fam Med* 2006; 19(5):511–516.
21. Reilly JS, Walter MA, Beste D, et al. Size/shape analysis of aerodigestive foreign bodies in children: a multi-institutional study. *Am J Otolaryngol* 1995; 16(3):190–193.