



Case Report

A Descriptive Case and Literature Review: Airway Foreign Body in a Child

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Abstract

Airway foreign body aspiration is unfortunately common when it comes to paediatric population and it still poses many challenges due to vague history, diverse presentation, difficult diagnostic modalities and retrieval intervention. This was the case of a long retained foreign body breathed into the lungs that led to complicated pulmonary events and sequelae. A detailed review of the literature will tackle the different medical aspects of this case and define the therapeutic role of bronchoscopy.

Keywords: foreign body aspiration, recurrent pneumonia, bronchoscopy, bronchiectasis.

Introduction

Foreign Body (FB) aspiration into the tracheobronchial system is a potentially life-threatening event and requires rapid recognition and management, as it can block breathing by impeding the airway, which can lead to asphyxia.¹ FB aspiration in children may be suspected if a choking episode is witnessed by an adult or remembered by the child. But unfortunately, the clinical presentation of unwitnessed FB aspiration may be elusive, and identification necessitates careful evaluation of the history, the clinical assessment along a thoughtful use of radiography and bronchoscopy.² Undiagnosed and retained FBs, may set grounds for long-term grave complications misleading the primary care physician.³ An irreversible impairment of the obstructed airways or parenchyma may occur, occasionally imposing a surgical resection.⁴

Here, we report a 12-year-old child with FB aspiration who firstly was brought to medical attention 2 years ago due to a new-onset cough, in the lack of a clear history of a choking episode. His course was significant for repetitive, symptomatic respiratory infections. His initial Chest X-Ray showed lingular and left lower lobe pneumonic consolidation (Figure 1). Unfortunately, he later required hospitalization, an enhanced CT scan of the chest showed a left lung large heterogeneous consolidation marked with abscesses and bronchiectatic changes (Figures 2a and 2b). A suspected obstructing lesion was described at the level of the left mainstem bronchus, differential diagnosis included mucous plugs or thick secretions. He was referred to our facility for further care. We involved a multispecialty team of Pulmonologist, Cardiothoracic surgeon and

Anesthesiologist, with a back-up surgical set. The child was moved to the operating room and under conscious sedation, using a flexible bronchoscope FUJIFILM EB-580 S, distal end diameter 5.3mm, working channel diameter 2.2 mm, the intervention was performed. A plastic blue tip was visualized in the left mid-mainstem bronchus, subtotally obstructing the lumen (Figure 3). An irregular border of granulation tissue was observed circumferentially, without clear adhesions on the plastic FB. The characteristics of the pen tip included smooth rounded borders difficult to get with the grasping forceps. The specifications of the forceps were as follows: jaw diameter 1.6mm, short-oval spoon shaped mouth with a window of 3mm. After several attempts, a 4Fr small Fogarty embolectomy catheter was fixed to the bronchoscope from outside and introduced concomitantly toward the obstructed airway. We were able to slide the catheter pass the pen tip and with soft inflation of the balloon and millimetric retrieval, we were able to mobilize the FB and dislodge it laterally in the same bronchus, in a position that allowed us to efficiently grasp it with the forceps (Figure 4). Excessive suctioning and lavage were performed after the successful extraction of the FB, this was sent for culture and identification. Air entry into the left lung improved immediately after removal of the FB. A post-procedural chest X-Ray was performed 4 hours after, it showed a partial re-expansion of the left lung field. The child recovered well and was discharged the same day. The follow up period is 6 months after this intervention, chest images show a remarkable lung re-expansion and recovery with a remaining localized area of bronchiectasis (Figure 5 and Figure 6). No antibiotic

course was necessary during this period, and the child was regaining weight, appetite and activity. This case is an example of challenges in diagnosing airway foreign bodies, difficulties in removal and complications that happens after a long retained period. The purpose of this paper is to share experience on providing bronchoscopy as a diagnostic and therapeutic tool to patient with an airway foreign body. Further, through a detailed review of the literature, the management is discussed.



Figure 1. Initial chest X-Ray showing a large consolidation of the lingula and the left lower lobe



Figure 2A. Axial view of the enhanced CT scan of the chest

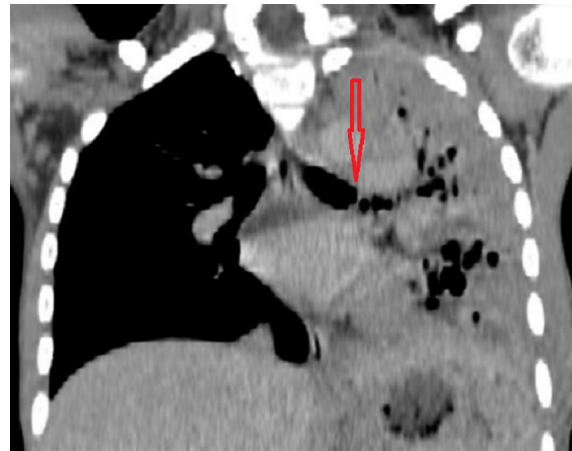


Figure 2B. CT scan showing evidence of severe left lung parenchymal damage

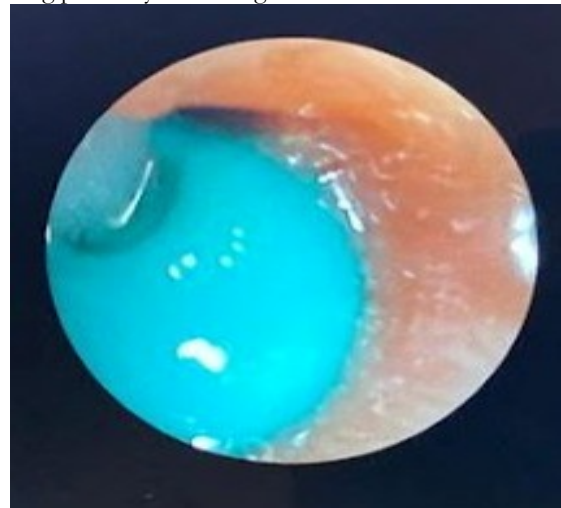


Figure 3. Rounded foreign body blocking the left main bronchus, as visualized by the flexible bronchoscope



Figure 4. Plastic pen tip extracted with the flexible bronchoscope.

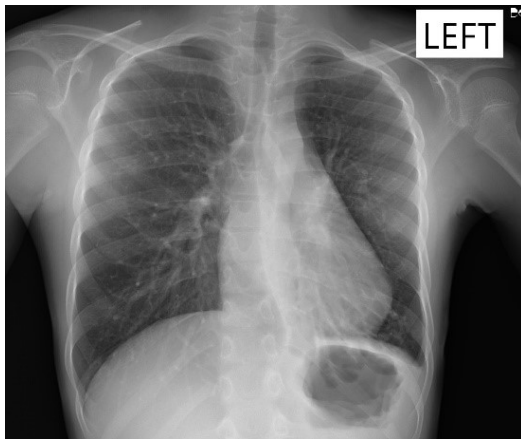


Figure 5. Chest X-Ray done 6 months after the intervention

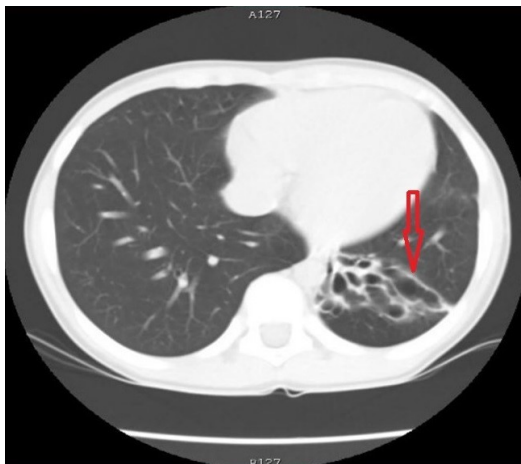


Figure 6. CT scan of the chest done 6 months after the intervention,

Epidemiology and Pathogenesis

Approximately 80 percent of pediatric FB aspiration episodes occur in children younger than three years,⁶ with some statistical data disclosing a bimodal age incidence, second peak around age of 10.⁷ As the skill to stand and grasp objects evolve with age, children start surveying their world via the oral route, putting them at higher risk for aspiration.⁸ Most case series in children report a male predominance, with a sex ratio ranging from 1.5:1 to 2.4:1.⁹

Big bulky FBs or those with sharp, uneven edges may obstruct the laryngotracheal tract and are associated with increased morbidity and mortality.^{10,11} The preferential right sided lung location is not found in children because both mainstem bronchi are similar in size and the angle

between the two is maintained till adolescence when growth and development make the right bronchus more in line with the trachea, thus relatively a straighter path from the larynx down to the bronchus. The site of a FB may also depend on the posture taken by the child at the time when the aspiration occurs.^{12,13}

Back to 1897, Gustav Killian, a German physician, achieved the first intervention by translaryngeal route, using an esophagoscope to retrieve a pig bone lodged in a farmer's right main bronchus.¹⁴ Later, Chevalier Jackson, named by some as the "father of endoscopy", advanced a bronchoscope with proximal illumination and dedicated instruments for the extraction of FBs.¹⁵ In 1968, Ikeda developed the flexible fibreoptic bronchoscope, after which several publications started coming out in the 1970s.¹⁶

Clinical Presentation

The initial presentation can be contingent to the degree of airway blockage, the site of the object, the age of the child, the characteristics of the aspirated object, as well as the elapsed time since the incident.¹⁷

Only around half of cases will present and be diagnosed within the first 24 hours,¹⁸ average 11.6 days in one retrospective large study.¹⁹ It has been also conveyed that 1 out of 5 child was given medications for other pulmonary diseases for longer than a month before a diagnosis was set.²⁰

Children who present with severe respiratory distress, cyanosis, and altered mental status have a true medical emergency that demands prompt recognition, life support and intervention. The laryngotracheal tract is involved in most cases.²¹

Fortunately, it is more common to see youngsters having a partial airway obstruction. The most common symptom is cough, followed by tachypnea, stridor and irritability, often with localized monophonic wheezing or decreased breath sounds.²²

The choking phase happens nearly after the episode and lasts few seconds to several minutes, occasionally with gagging and paroxysms of cough. This acute episode generally is self-limited and followed by a symptom-free interval, mostly from an accommodation of the mucosal cough receptors, which if misjudged as a sign of resolution, may delay the diagnosis.²³

The longer duration of the FB in situ leads to granulation tissue and airway lumen inflammation or later to infection, which may cause the symptoms to aggravate. Recurrent lung infiltrates and frequent antibiotic prescriptions are descriptive of that late phase.^{24,25}



Some organic FBs with a high oil content as peanuts, cause a significant mucosal inflammation and accretion of bulky granulation tissue in a short period of time. Such cases will present weeks to months later. Moreover, objects as beans, corn and seeds can absorb humidity and intraluminal secretions with subsequent swelling, so partial obstruction can change to total obstruction and lead to delayed symptoms and presentation.²⁶

Types of Foreign Bodies

Commonly aspirated FBs in children include peanuts or other nuts in Western society and seeds particularly watermelon in Middle Eastern countries. Food items are the most common stuff aspirated by infants and toddlers, whereas nonfood items (ie: pen caps, coins, clips, pills) are more frequently aspirated by older children.^{27,29}

Also the traditional habits of some societies may prompt unusual kinds of aspiration, as for instance, turban pin aspiration reported in Muslim girls who held the pin between their lips while preparing or adapting their hijab.³⁰

Diagnostic Evaluation

A normal initial chest radiograph is found in at least 30 percent of cases.³³ Most of the FBs aspirated are radiolucent, hence, indirect radiological findings should be alleged.

In a low suspicion context, normal plain radiographs are enough to conditionally exclude FB aspiration. Yet, these patients should be home followed over 2 to 3 days with low threshold for auxiliary assessment if symptoms persist or progress.

On simple chest X-Ray, common radiographic findings are:^{31,32}

- Abnormal lucency distal to the obstruction site, causing an asymmetrical hyperinflation. This is the result of a check valve mechanism, or air trapping.
- Atelectasis or segmental collapse may occur when air is resorbed from the distal alveoli over time.
- In some cases, the Radiologist may describe an interrupted bronchus sign.
- With time, an infectious pneumonia often develops distal to the obstructed airway. Post-obstructive abscesses and localized bronchiectasis are a potential late manifestations of a retained airway FB.

If a laryngotracheal FB is suspected, a posteroanterior and lateral views radiography of the neck should be done.³⁴

The CT scan raises the sensitivity to almost 100 percent in diagnosing a FB aspiration and is considered a valuable diagnostic tool or imaging modality.³⁵

MRI is particularly useful for identifying high fat containing bodies as peanuts, which provides high contrast differentiation. However, it requires sedation in young children and is rarely used.³⁶

In some centers, Fluoroscopy is still being done looking for an abnormal mediastinal shift with decreased excursion of the diaphragm, found only in half of cases, the child imaged in the lateral decubitus position, lying on the presumed affected side.³⁶

CT virtual bronchoscopy creates images close to the real anatomy and help to localize the FB, but requires a highly advanced software.³⁷

Foreign Body Removal and Utility of Flexible Bronchoscopy

Once the diagnosis of FB aspiration has been established, the object should be removed as quickly as possible.

The procedure of choice is the rigid bronchoscopy, used to visualize and safely extract the object. It allows airway ventilation throughout the procedure, rarely exceeds half an hour and uses a wide variety of instruments in parallel with a good control of any potential mucosal bleed.^{38,40} Alternatively, an experienced operator can use the flexible bronchoscope. It can be done under conscious sedation and has the ability to successfully reach the segmental bronchi.³⁹

The choice of retrieval instruments, when available, depends on several factors as the dimension, shape, estimated weight and texture of the FB to be extracted:

- For small and friable FBs, retrieval baskets and snares are best used.
- For firm, less friable FBs, grasping forceps or rubber-tip forceps are preferred. Some centers have a magnet-tip probe used for objects with ferrometallic properties.
- For sharp or irregular FBs, alligator forceps are preferred.

In rare cases, additional maneuver can be carefully performed. This helps to loosen the FB up into a larger airway, more favorable for grasping and retrieval. In experienced hands, sliding a small embolectomy-type balloon across the obstructed site then gently inflating and retracting it in order to dislodge the object. In the setting of prolonged inflammation and formation of granulation tissue, the FB can be released by applying laser or argon plasma coagulation, making the extraction easier.



After securing the FB, removal of it through the grasping device and bronchoscope should be done as one unit, in a coaxial movement, with careful attention to stay in the center of the airway and to maintain visualization of the FB all through this maneuver. During the last step of retrieval, a special caution should be made to pass the narrow glottic area or the vocal cords.

Spontaneous expelling is not very advised as it may dislodge the FB more proximally and worsen the airway obstruction.⁴³

In peripheral locations or with failed bronchoscopic removal, around 2 percent of cases, a surgical intervention is required.⁴⁴

Conclusion

Accidental inhalation of foreign bodies into the respiratory tract remains a frequent cause of childhood morbidity and mortality. An early recognition is a key, through a good history and physical exam. Commonly the clinical presentation is very vague in the absence of a choking episode, thus misleading the management. This suspicion should be raised when the child suffers from chronic pulmonary infections, unexplained persistent cough, asthma-like symptoms, refractory unilateral parenchymal infiltrates or bronchiectasis. The physician should ask for chest imaging as plain radiography or in selected cases, CT scan for better visualization. The algorithm is completed by a confirmatory and therapeutic intervention, which relies on rigid and/or flexible bronchoscopy. More effort in the caregivers' education and public awareness is warranted as anticipatory prevention, but also readiness of the healthcare system.

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Questions (True or False):

- 1- Aspiration of a foreign body is common in children and easily diagnosed in the emergency care.
- 2- When clinically suspected, the child should get both a neck and chest X-Ray as part of the investigations.
- 3- The interventional practitioner should consider different extraction instruments that go through the bronchoscope channel depending on the characteristics of the foreign body.



4- In chronically retained foreign bodies, without clinical impact, observation is recommended with regular follow-up chest imaging.

Public awareness is considered an important primary preventive measure

Answers:

1-F, 2-T, 3-T, 4-F, 5-T.