Foreign Body Aspiration in Children – A Report of Five Cases

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INTRODUCTION

Tracheobronchial foreign body aspiration (FBA) is a major cause of morbidity and mortality in children (1−4). The child may present acutely with evidence of respiratory distress or chronically with symptoms suggestive of respiratory infection or impairment. Prompt diagnosis and expeditious removal of the inhaled foreign body are essential to minimize the associated morbidity and mortality (3). Effective management requires a coordinated, skilled and multidisciplinary approach involving the use of multiple resources. We report a series of five cases illustrating the variable presentations of FBA in children and the management of these challenges.

Keywords: Bronchoscopy, children, diagnosis, foreign body aspiration

Case Reports

Case 1

A 1-year-old girl suddenly started coughing vigorously while playing with some plastic clothes pins her mother was using to hang out clothes to dry. The mother noticed that the girl had pieces of the clothes pin in her mouth. The mother claimed to have removed all the pieces from the child's mouth. However, the child continued to cough intermittently and gradually developed breathlessness and hoarseness over the next couple of days. She was taken to the health centre where she was treated for asthma for 3 months without relief. A referral to the ENT Clinic was made. On examination, she was not pale, febrile or cyanosed but had evidence of mild to moderate respiratory distress with moderate flaring of the alar nasi, intercostal and subcostal recession and tachypnoea. On auscultation, she had stridor and transmitted sounds in both lung fields. Plain radiographs of the neck and chest were normal (Fig. 1) Based on the history, she was scheduled for diagnostic rigid bronchoscopy under general anaesthesia in the operating room. At endoscopy, a foreign body was found between the vocal cords and hooked at the anterior commissure. It was a broken plastic angle piece from the clothes pin (Fig. 2). Immediately after the procedure, the stridor disappeared and the child's clinic follow-up visits were unremarkable.

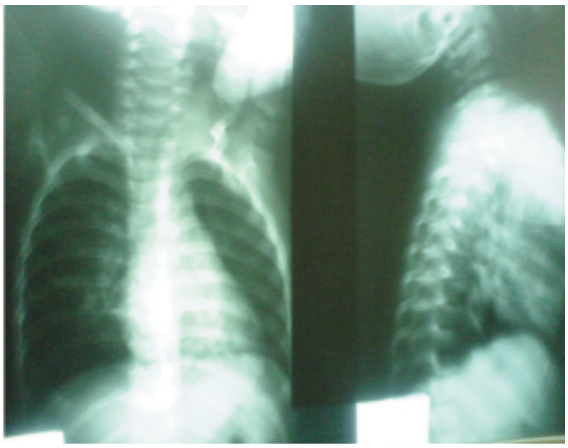

Fig. 1: Normal thoracic inlet and chest radiographs of case 1 who had a FB impacted in larynx.

Fig. 2: Extracted plastic piece of clothes pin from case 1.

Case 2

A 5-year-old boy was eating some cherries and then suddenly began coughing violently for about one minute. He subsequently continued to have intermittent episodes of dry cough. He was taken to the hospital on the fifth day. On physical examination, he was not in any significant respiratory distress but there was reduced movement and air entry on the right side of the chest and dullness to percussion also on the same side. The chest radiograph was reported as normal (Fig. 3). He was immediately scheduled for diagnostic bronchoscopy. At endoscopy, using a rigid bronchoscope under general anaesthesia, a cherry seed was extracted from the right main bronchus (Fig. 4). In the immediate post-procedure period, chest movement and air entry on both sides of the chest were normal. He was discharged on the second post-procedure day. Follow-up was uneventful.

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Fig. 3: Normal chest radiograph in case 2.

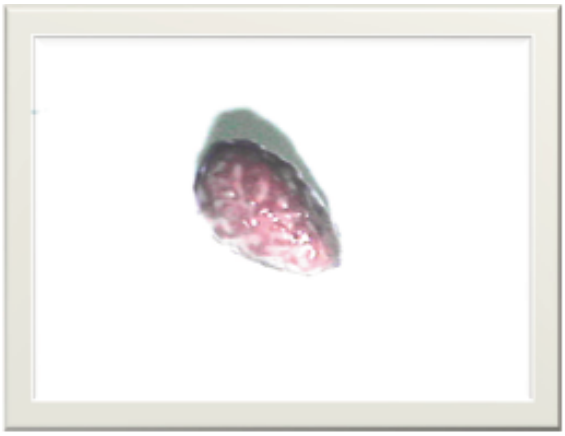

Fig. 4: Cherry seed extracted from right main bronchus of case 2.

Case 3

An 11-year-old male claimed that he had accidentally 'swallowed' a metal pin ten days prior to presentation at the ENT Clinic. He denied any symptoms related to the foreign body. Clinical examination of the chest was unremarkable. A chest radiograph showed a 1.5 cm pin in the right main bronchus (Fig. 5). The pin was extracted uneventfully under general anaesthesia *via* a rigid bronchoscope (Fig. 6). Post-procedure, his chest was clinically and radiologically normal. He was discharged on the second post-procedure day.

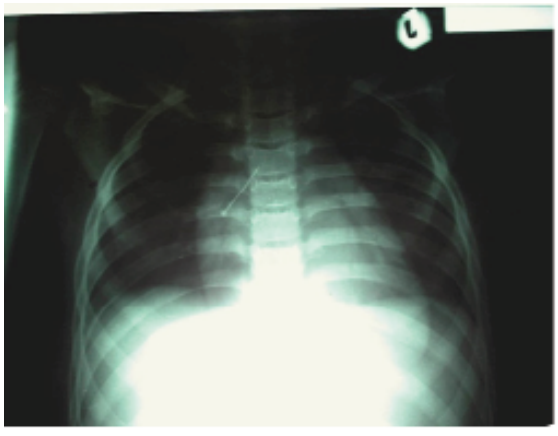

Fig. 5: Pin in right main bronchus of case 3.

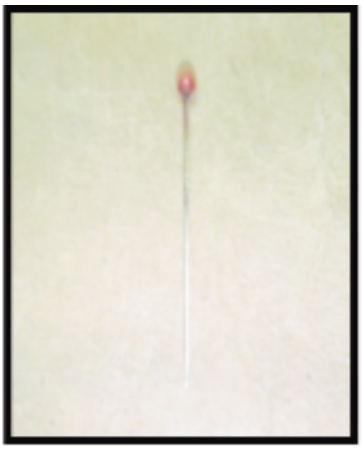

Fig. 6: Extracted pin from case 3.

Case 4

A 15-year-old male had aspirated a thumb pin 3 years prior to presentation at the clinic. He had been treated repeatedly during this period of 3 years for recurrent episodes of cough, dyspnoea and fever. On examination, he was irritable, coughing intermittently with production of foul-smelling muco-purulent sputum. He was febrile, pale and tachypnoeic. Air-entry on the left chest was reduced with some wheezing. Percussion over the left chest was dull compared to the right. A chest radiograph showed a thumb pin (commonly used in offices) in the left main bronchus with associated fibrosis and consolidation of the left lower lung field (Fig. 7). Rigid bronchoscopy under general anaesthesia was immediately scheduled to extract the thumb pin. During bronchoscopy, granulation tissue was noted around the pin. Attempts at extraction led to significant bleeding and the procedure was discontinued. The patient was started on antibiotics and steroid therapy. A post-procedure chest radiograph indicated that the foreign body had shifted from the left

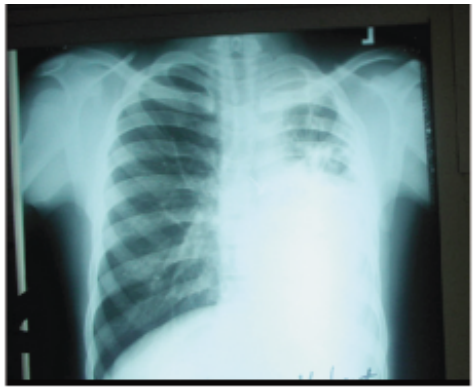

Fig. 7: Thumb pin in left main bronchus of case 4.

main bronchus to the right main bronchus (Fig. 8). Four days after the initial unsuccessful bronchoscopy, a second attempt

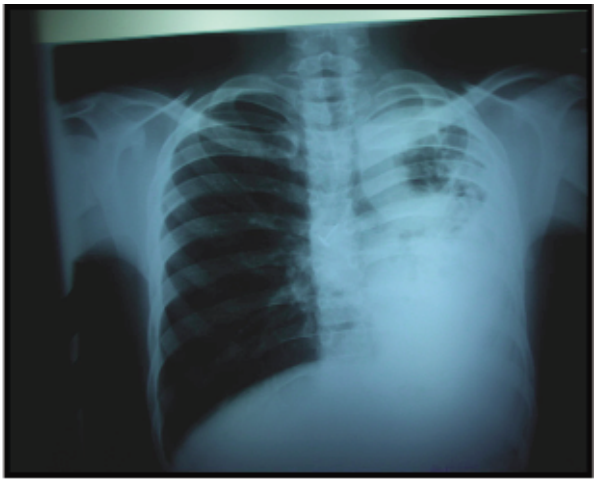

Fig. 8: Thumb pin shifted to the right main bronchus after attempt at extraction in case 4.

Note emphysema on right lung field and atelectasis on left lung field with left tracheal deviation.

was made and the thumb pin was successfully extracted via a rigid bronchoscope. The left main bronchus still had significant granulation and firm fibrous tissues. Chest radiographs immediately after the extraction and at one month after the procedure indicated no change and there was persistence of the lung pathology with fibrosis and atelectasis on the left side and emphysema on the right side with deviation of the trachea to the left side.

Case 5

An 8-year-old boy claimed that he was using a metal pin as a 'tooth pick' and accidentally 'swallowed' it when he presented at the ENT Clinic the following day. Clinical examination of the chest was unremarkable. A chest radiograph showed a pin in the mid-trachea (Fig. 9). The pin was successfully extracted using a rigid bronchoscope under general anaesthesia. He was discharged the next day and follow-up visits were unremarkable.

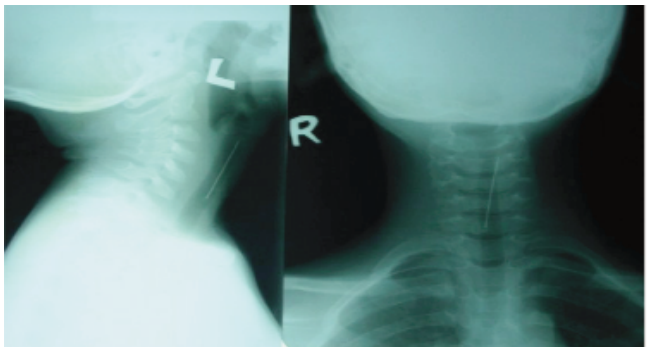

Fig. 9: Pin in trachea of case 5.

DISCUSSION

Tracheobronchial foreign body aspiration is a common medical emergency in children especially in the age group between 1−3 years (1−4). It is a major cause of morbidity and is the leading cause of accidental deaths in children under 6 years in the USA (1, 4, 5). At this age group, children lack molars for proper mastication of food, they are also more ambulant and are curious to explore their surroundings. They also tend to put objects impulsively into their mouth more frequently. The degree of respiratory distress is greater in the smaller child because of the relatively smaller size of their airways. Tracheobronchial foreign body aspiration can be a life- threatening emergency if the object completely obstructs the airway leading to asphyxia and rapid death. Lesser obstruction may result in no or less severe signs and symptoms.

As noted from the present case series, the foreign body (FB) can be lodged anywhere along the tracheobronchial tree, from the vocal cord to the bronchioles and it can be any type of material. The presenting signs and symptoms can be very variable and the time from aspiration to diagnosis can range from minutes to days or months.

In children, FBs can be lodged anywhere along the tracheobronchial tree. Most large series indicate that the majority of objects are lodged in the main bronchi with a slight predilection for the right side over the left (6, 7). The reason for this is partly anatomic. Whereas most FBs aspirated in adults are lodged in the right bronchus because of its more acute angulation and greater internal diameter, the bronchi of children less than 15 years old are similar in size and in angulation (8).

The majority of FBs in children worldwide are organic and mainly of vegetable origins such as peanuts and seeds (1−4, 6, 7, 9, 10). Vegetable type FBs are more problematic than non-organic matter because they usually absorb moisture and swell thus increasing obstruction of airways distally. They are also more likely to induce intense inflammatory reactions, oedema and granulation tissue formation (1, 3, 6, 7). During attempts to extract organic FBs, they are more likely to disintegrate as they are more friable and the pieces may disperse more distally. Most organic or vegetable FBs are not radiopaque thus contributing to delays in diagnosis (9, 10)

The signs and symptoms associated with FBA in children are highly variable which may account for the frequent misdiagnosis or delayed diagnosis (1, 6, 7, 9−13). In large reviews, the diagnosis of FBA was made correctly within the first 24 hours after aspiration in only about 50% of cases (1, 2, 7, 12). The clinical features at presentation are mostly dependent on the type of FB, the location and the duration since inhalation. Presentation can therefore vary from almost asymptomatic to life-threatening airway obstruction. The most common symptoms in childhood FBA are choking, persistent coughing, wheezing, stridor and pneumonia (1−7, 9−12).

Many experts and authorities emphasize that the history is often the most important (and sometimes the only) clue to diagnosis as physical signs and radiological investigations may be absent or even negative in the presence of a foreign body (1−7, 9−12). A witnessed aspiration or self-report obviously has the highest sensitivity in diagnosis but a suggestive history must be taken seriously even in the absence of clinical or radiological findings. Note however, that younger and preverbal children may not be able to volunteer a history and older children may be reluctant to do so for fear of reprimand or punishment.

The most common investigation carried out in patients with suspected FBA is a plain chest radiograph. All our patients had this done and two of our five had normal radiographs. Similar findings of normal chest radiographs in the presence of aspirated FBs are reported in several studies and surveys (1−7, 9−14). Between 10 to 40% of patients with endoscopically confirmed aspirated foreign bodies do not have abnormalities in their chest radiographs (1, 2, 9, 13, 14). While a chest radiograph is very helpful in diagnosis of FBA, as illustrated in three of our cases, many aspirated foreign bodies are not radiopaque. A radiolucent foreign body may be suggested only by secondary changes such as segmental or lobar collapse, air trapping, atelectasis, infiltration and bronchiectasis. These findings are however not specific and may be found in the absence of foreign bodies (1, 2, 9, 13, 14). Though it is readily available and cheap, a plain chest radiograph has relatively low sensitivity and specificity for identifying inhaled foreign bodies and should therefore not be relied on in confirming or excluding a diagnosis of FBA (1, 2, 9, 13, 14).

A promising new diagnostic aid is virtual bronchoscopy. It is a reliable, non-invasive 3-dimensional representation of the tracheobronchial tree and surrounding structures created from spatial information derived from various imaging sources (15). Importantly, virtual bronchoscopy can show the exact location of a foreign body before bronchoscopy and can be used to rule out FBA in patients with a low level of suspicion and normal or nonspecific findings in chest radiography (16). However, this is still mainly a research tool and is unlikely to be readily available soon in routine clinical areas especially in resource-challenged countries.

Aspirated FBs should be extracted as soon as possible as delays in diagnosis and extraction are always associated with increased complications. The incidence of complications increases after 24−48 hours, making expeditious removal of the foreign body imperative (1, 9−12). Duration of rigid bronchoscopy is often prolonged in delayed cases because of severe mucosal changes or difficulties in foreign body extraction and this increases complication rates significantly (17, 18)

This small series of illustrative cases highlight some of the challenges in managing children with FBA and are corroborated by other studies worldwide. The diagnosis of FBA still remains a challenge with a high incidence of delayed and missed diagnosis (11, 12). Since the physical and radiological examinations do not have very high sensitivity and specificity in the diagnosis of FBA in children, there should be a high index of suspicion in any child with suggestive symptoms and signs of choking, persistent coughing, wheezing or stridor, or evidence of asthma-like symptoms or respiratory tract infection which is unresponsive to usual therapy. Unfortunately, there is still low awareness of FBA as a cause of respiratory symptoms among both the public and general medical practitioners. Because of the increased risks and complications associated with missed or delayed diagnosis, early resort to bronchoscopy is often preferred for definitive diagnosis and treatment (1, 11−14). The risks of complications of bronchoscopy are low compared to the risks associated with delayed or missed diagnosis of FBA (17).

Rigid bronchoscopy is the preferred technique for definitive diagnosis and extraction of inhaled foreign bodies in children because it is safe, simple and effective in experienced hands (1, 6, 9, 10). The procedure requires a team approach consisting of a minimum of an experienced endoscopist, an experienced anaesthesiologist and a scrub nurse. With the advances in patient monitoring and the availability of safer anaesthetic agents, anaesthesia for endoscopy has become very safe and straightforward, with most of the endoscopy-related complications now being due directly to the endoscope manipulation or to the foreign body itself (17, 18). The goal of anaesthesia is to ensure unconsciousness and analgesia of the patient in addition to facilitating the endoscopic process by avoiding any coughing, bucking, straining or other sudden movements. The main anaesthesia-related problem is that of the ‘shared airway’ whereby both the endoscopist and the anaesthesiologist are competing for the same airway (17, 18, 20, 21). A high degree of understanding, cooperation, collaboration, and coordination is required between them to avoid hypoxia to the patient. Hypoxia is the most commonly observed adverse event during rigid bronchoscopy for removal of FB (21). The identified factors associated with increased risk of intra-and postoperative hypoxia were younger patients, organic type of FB, long duration of surgical procedure, pneumonia before the procedure and spontaneous rather than controlled ventilation mode (21).

All foreign bodies were extracted using the rigid Karl Storz bronchoscope with the ventilating side-port which allows frequent intermittent oxygenation of the patient. None of the patients required post-procedure endotracheal intubation although this may be necessary in cases of significant post-endoscopy airway trauma and mucosal oedema that may compromise effective spontaneous ventilation and optimal oxygenation (6, 7, 17, 18).

Although rigid bronchoscopy is the preferred technique for removal of aspirated FB in children, it must be noted that complications can and do occur (2−4, 6, 7, 9−14, 17, 18, 20). These include bronchospasm, laryngospasm, hypoxia, car-

diac arrhythmias, trauma to the airway, haemorrhage and surgical emphysema in addition to the anaesthetic-related complications. The decision to undertake bronchoscopy should therefore not be taken lightly. Exposing all children with a suspected history of FBA alone to rigid bronchoscopy may result in a high rate of negative bronchoscopies with the attendant risks associated with the procedure. The rate of positive rigid bronchoscopies reported in the literature ranges from 25−90% depending on the criteria used for performing bronchoscopies (2, 7, 11, 14). In a bid to minimize unnecessary rigid bronchoscopies, a number of recent evidence-based clinical algorithms have been proposed (2, 11, 22). In summary, these algorithims suggest that rigid bronchoscopy is first choice in all cases of asphyxia, a radiopaque FB, unilateral decreased breath sounds, obstructive emphysema, and significant mediastinal shift, while for children with persistent symptoms such as cough, dypsnoea, fever or any abnormal physical or chest radiographic signs, a flexible bronchoscopy should be used initially for diagnosis proceeding to rigid bronchoscopy if necessary. Bronchoscopy is not necessary in asymptomatic children with normal physical and radiological examinations who should be followed clinically.

Recent reports have indicated that flexible fibreoptic bronchoscopy is a safe and cost-saving procedure in children with suspected FBA as the complications associated with general anaesthesia and rigid bronchoscopy are avoided (2, 11, 22). In facilities where expertise in flexible paediatric bronchoscopy exist, this technique may significantly reduce the number of rigid bronchoscopies performed. In other words, if the diagnosis is almost certain use a rigid bronchoscope but if in doubt, confirm with a flexible bronchoscope.

The current literature indicates that morbidity and mortality should be very minimal or nil when endoscopy is performed by a skilled and experienced team (1−4). Complication rates for removal of FBs depend on the operators skill and experience, anaesthesia type, patient condition and availability of appropriate instruments. Except in the asphyxiating child, most cases of FBA are not dire emergencies and it may be preferable to transfer such children to centres with recognized expertise in these procedures (11).

Tracheobronchial foreign body aspiration is a highly preventable condition (5). Parents should be educated about the risks of particular food types and should minimize the availability of small pieces of articles and toys around toddlers (1, 4, 5). Lessons in basic first aid especially about choking should also be taught to parents (5).

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