

Management of Foreign Body Aspiration with Flexible Bronchoscopy: A Case Series

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Abstract: Foreign body aspiration (FBA) in lower respiratory track is a rare but life-threatening condition that needs early management to prevent serious complication. We present four cases of FBA that admitted to Wangaya General Hospital Denpasar during June 2021 to July 2022. The three cases were aspiration of organic foreign body in adults and one case was the aspiration of an inorganic foreign body in children. Management of FBA was performed by flexible bronchoscopy and removed using wire basket instrument. In conclusion, aspiration should be considered in those with known risk factors accompanied with clinical sign even if radiological findings are negative. Flexible bronchoscopy is the first choice in diagnosis and management FBA and the patient improve significantly after the foreign bodies were removed.

Keywords: foreign body aspiration, foreign body, flexible bronchoscopy, wire basket

1. Introduction

Foreign body aspiration (FBA) is a rare, but life-threatening condition with high mortality risk in the case of total obstruction.^{1,2} FBA most often affects children, with 75% to 85% of cases occur in children under 15 years old.^{3,4} However, it can occur in adults with the highest incidence in the sixth decade of life and the risk increases with age.^{5,6} Foreign bodies are broadly classified into 2 groups, include organic (e.g., peanuts, chicken or fish bones, seeds, etc.) and inorganic (e.g., plastic caps, pins, plastic pieces, etc.).²

The symptoms vary from asymptomatic to causing life-threatening complications.^{2,7} Sometimes the symptoms are non-specific and mimic other respiratory diseases which include cough, shortness of breath, hemoptysis and/or wheezing.⁵ The diagnosis of FBA can be challenging in particular as most aspiration event occur unnoticed resulting in delayed or missed diagnosis. Delayed diagnosis may lead to serious complications such as recurrent pneumonia, bronchiectasis, recurrent hemoptysis, pneumothorax, lung abscesses, pneumomediastinum.^{7,8} Bronchoscopy is the method used to diagnose and management of foreign body aspiration, either rigid or flexible bronchoscopy, depending on the location and type of foreign body.⁷⁻¹⁰

We present four cases of foreign body aspiration that were successfully managed by flexible bronchoscopy.

2. Case Series

A total of four cases were admitted to Wangaya General Hospital Denpasar Bali from June 2021 to July 2022. There were 3 adults and 1 child that underwent flexible bronchoscopy for the extraction of foreign bodies.

Case 1

A 66-year-old male was admitted to the emergency department with sudden-onset difficulty breathing that occurs 1 hour before arrived. He had a brief choking episode at the beginning when he had lunch. He also complained of chest pain. He has no other symptoms such as a sore throat, nasal discharge or fever. He denied history of chronic obstructive pulmonary disease (COPD) and other respiratory disease. He has a history of smoking 3 cigarettes a day for 30 years, but he quit smoking 5 years ago.

The oxygen saturation value was 88% room air on admission, respiratory rate was 28/minute, blood pressure and other vital sign were within stable range. On physical examination, he was found to have unilateral wheezing in the right lung. A chest radiograph revealed emphysematous lung and increase in bronchovascular pattern (figure 1). The laboratory examination in normal range. He was presumptively diagnosed with AE-COPD and suspect foreign body aspiration, treated with empiric antibiotic, nebulized B-agonist, and steroids.



Figure 1: Chest x-ray show emphysematous lung and increase bronchovascular pattern

Flexible bronchoscopy was performed in the next day and foreign body was seen in the inferior lobe of right main bronchus (figure 2). Foreign body was extracted using wire basket with visualization through a monitor. The foreign body was successfully removed with an oval shape, size 1 x 0.5 x 0.5 cm, dark brown in color and known as peanut

(figure 3). Further re-evaluation, the bronchial mucosa appears hyperemic, edematous and minimal bleeding. After procedure, the patient's clinical condition improved and discharge next day.

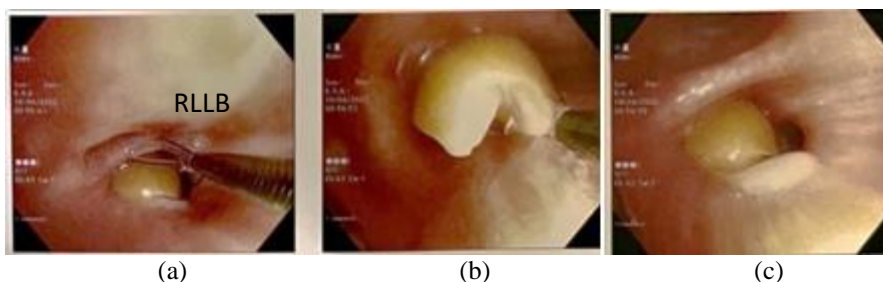


Figure 2: (A) Bronchoscopy show FB in inferior lobe right bronchus (B) (C) showed extraction of the FB by wire basket



Figure 3: Foreign body (peanut) extracted from case 1 with oval shape, size 1 x 0.5 x 0.5 cm, dark brown in color

Case 2

A 55-year old female was admitted to emergency department with shortness of breath and cough. The patient stated that the cough had been ongoing for the past 2 months and was accompanied by a fever. She started complaining of dyspnea one week ago, but worsened today. One month ago, she was diagnosed pneumonia and given a seven-day course of levofloxacin with temporary improvement in symptoms. She has no other respiratory symptoms such as chest pain, sore throat, or nasal discharge. She had poorly controlled hypertension and denied other past illness. She denied a history of choking events or trauma.

Upon admission, her vital signs were as follows: blood pressure, 161/76 mmHg; respiratory rate, 30/minute, and oxygen saturation on 3 L/minute nasal cannula oxygen, 98%; temperature and heart rate normal. Chest auscultation revealed rhonchi in right lung field. Laboratory examinations were in normal range. Blood gas analysis on admission revealed pH: 7.37; pCO₂: 50 mmHg; and bicarbonate 29 mmol/L with fully compensated respiratory acidosis. Chest radiograph showed cardiomegaly, right-sided infiltrative pattern and air bronchogram in lower right area (figure 4). She administered parenteral levofloxacin and ceftazidime. We decided to do a flexible bronchoscopy due the response to these drugs was limited. Unexpectedly, flexible bronchoscopy showed foreign body in inferior lobe of right bronchus with surrounding granulation (figure 5).



Figure 4: Chest x-ray show infiltrate and air bronchogram in lower right area (arrow)



Figure 5: Bronchoscopy show FBA in right lower lobe bronchus that totally occluded with granulation

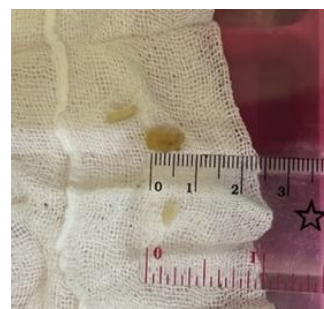


Figure 6: Foreign body extracted from case 2 with size 0,7 x 0,5 x 0,5 cm (peanut)

The foreign bodies are known as a peanut (figure 6) with size 0,7 x 0,5 x 0,5 cm was successfully removed by wire basket instrument. Removal of foreign body lead significant improvement of the patient both clinically and radiographically (figure 7). Later, the patient was not able to

recall the events of choking. The patient's dyspnea and chronic cough resolved and she remains asymptomatic.



Figure 7: Chest x-ray on 3 days after extraction of foreign body

Case 3

An elderly (72-year-old) male previously diagnosed with COPD was admitted to the hospital due to worsening of shortness of breath and productive cough since one week earlier. He denied a history of smoking, but exposure by dust and pollution as he worked at a construction building. He routinely got COPD medication such as tiotropium bromide inhaler and salmeterol xinafoate/fluticasone propionate inhaler at polyclinic for three years.

On admission, his oxygen saturation was 89% on room air and respiratory rate 30/minute. From physical examination found rhonchi and expiratory wheezing in both lung field. Laboratory investigation showed leukocytosis ($18,61 \times 10^3/uL$) with shift to the left. Chest x-ray suggestive for COPD with consolidation in right parahiler, paracardial and left parahiler (figure 8).



Figure 8: Chest x-ray showed increased bronchovascular pattern, hyperinflated lung fields with diaphragmatic flattening and hyperlucency suggestive for COPD. Infiltrates in the right parahiler, right paracardial and left parahiler

Prior to the admission, he suspected acute exacerbation of COPD and treated with empiric antibiotic, nebulized B-agonist and steroids. However, because there was no significant improvement, we decided to do bronchoscopy to evaluate the airway. Flexible bronchoscopy was performed and round, smooth foreign body was seen in the right lower lobe bronchus surrounding with granulation, then removed with wire retrieval basket (figure 8). The foreign body was known as peanut with the size $1 \times 0,4 \times 0,4$ cm (figure 9). After removal, the patient showed improvement of clinical condition then discharge the day after extraction. He was seen the outpatient department and continued receive controller inhaler.



(A)



(B)

Figure 9: Bronchoscopy show FB. (A) a peanut was lodged in the right lower lobe bronchus. (B) showed extraction of the FB with wire basket

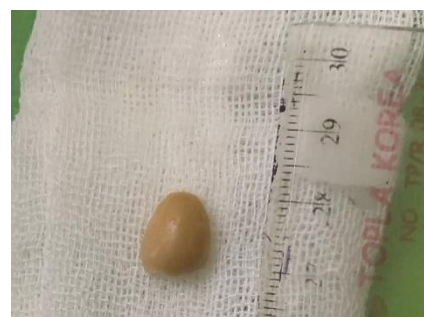


Figure 10: Foreign body extracted from case 3 known as peanut with the size of 1 cm

Case 4

A 7-year old male was referred from East Sumba Hospital with airway obstruction due to foreign body inhalation. He was accidentally inhaled a component of a plastic pen stopper-end about 1 weeks earlier while he was playing with. In East Sumba, bronchoscopy revealed the presence of a foreign body but failed to extraction.

On presentation, his oxygen saturation was 96% with NRM Oxygen and the respiratory rate was 38/minute. On physical examination found subcostal retraction. On auscultation, there was reduced air entry in the right lung, rhonchi and wheezing in both lungs field. X-ray chest (AP view) did not show the possibly foreign body (figure 10). Laboratory investigation showed leukocytosis (16.140/uL) and other blood test were normal. Blood gas analysis on admission revealed pH: 7.44; pCO₂: 45 mmHg; and bicarbonate 31 mmol/L, confirming fully compensated respiratory acidosis.



Figure 11: Chest x-ray

Repeat flexible bronchoscopy was performed under general anaesthesia. The foreign body was showed in right main bronchus (figure 12), then was tried to be extracted with forceps but failed. On second attempt, the foreign body was successfully removed with wire basket. The inorganic foreign body was with a tube shaped, green in color that known as a plastic pen stopper-end (figure 13). After removal of the foreign body, the patient's condition improved and we released him when he got fully recovered three days later.



Figure 12: Bronchoscopy showed FB in right main bronchus



Figure 13: Inorganic FB extracted from case 4: tube shaped, green in color (plastic pen stopper-end)

3. Discussion

Foreign body aspirations (FBA) is aspirate objects originating from outside the body or inside the body that in normal circumstances there is not in respiratory tract. FBA is commonly in children, especially under 3 years of age.¹⁻⁴ Males are found to be more common present.^{6,10} In adults, the highest incidence is in the sixth decade of life and the risk increases with age.^{5,6} Most patients have underlying risk factors, while 10% have no known risk factors.⁵ Aspiration occurs as a result of decreased airway protection mechanisms, impaired cough and swallowing reflex that can be found in individuals with neuromuscular disorders, altered mental status, head trauma, or alcohol use.^{2,5} In children, they have the tendency to play during food ingestion and they tend to recognize objects by mouthing, thus causing accidental ingestion.^{3,11}

Aspiration can have variable clinical manifestation, from asymptomatic to causing life-threatening complications. The most common symptom is choking followed by a productive cough, shortness of breath, chest pain, and fever.^{5,6} Sometimes the symptoms are non-specific and mimic other respiratory diseases such as bronchitis, pneumonia, or an acute exacerbation of COPD or asthma. Clinical history taking is the most important element to make diagnosis of foreign body aspiration.⁵ Multiple case series showed that patient often do not recall the aspiration event that lead to misdiagnosis or delayed diagnosis.^{2,6,12,13} However, some patients could recall choking episodes after more thorough history taking.² Analogous to this finding, two patients had the history of choking episodes in the admission, but another two cases were explored after the diagnosis was confirmed by bronchoscopy. On physical examination, stridor, unilateral wheezing or decreased breath sounds may be found.⁶

The type of foreign bodies are divide into organic and inorganic.² In the elderly, about 80% of foreign bodies are the form of food particles such as peanuts, vegetables, fruit seeds, chicken bones and fish bones.^{9,12} Similar in the children, organic materials are commonly found as aspirated object.^{3,5,12,13} However, the most common inorganic aspirated in children were stationery items that similar in this case.³ Due to their capacity to absorb moisture, organic materials are known to cause more complications that result in partial to complete airway obstruction.^{2,9,14} Also, they cause a significant inflammatory reaction in bronchial tissue.² In the short term, granulation tissue may form, creating a risk of bleeding during extraction. Furthermore, in long-term complications, granulation and mucosal injury can develop into cicatricial tissue and airway stenosis.¹⁰ In this report, granulations were found in two patients with chronic aspiration.

A foreign body aspirated into the air passage can lodge in the larynx, trachea, or bronchi. Of these cases, 80% to 90% are found in the bronchi because the size of most aspirated foreign bodies and their configuration allow passage through the larynx and trachea.² The most predilection of foreign bodies are in the right bronchus, especially in the right lower lobe due to the vertical orientation of the airways.^{1,2,5,7,14} In this series, foreign bodies of three cases were found in right

lower lobe and one other case of a child was found in the right main bronchus. In adults, the right main bronchus is shorter than the left main bronchus and forms an angle of 25 degrees from the median line, whereas the left main bronchus forms an angle of 45 degrees. Thus, the right main bronchus almost forms a vertical orientation with the trachea, so that foreign bodies will more easily enter the right bronchus.^{4,5}

Similar with clinical manifestations, radiological findings may vary. Chest X-ray is the first approach used to assess the presence of foreign bodies, although as 80% of foreign bodies are organic materials that appear radiolucent.^{5,9} The presence of lobar pneumonia, bronchiectasis and atelectasis due to airway obstruction can be found in the first 24 hours. In this series, all the foreign bodies are not detected in plain radiograph. Thoracic computed tomography (CT)-scan is a more sensitive examination in assessing aspiration.^{4,5}

In high clinical suspicion of aspiration, bronchoscopy should be performed even though radiological examinations absent. Bronchoscopy procedure is the main choice in the diagnosis and management of FBA.⁴⁻⁸ Bronchoscopy was first introduced by Gustav Killian in 1897 to take foreign bodies. Furthermore, Shigetokida developed flexible bronchoscopy in 1968.⁶ Flexible bronchoscopy is the first choice in treating foreign body aspiration in adults, with a success rate of 90%.^{4,5,8} Various instruments have been developed in bronchoscopy to extract foreign bodies, including grasping forceps, balloon catheters, retrieval baskets, snares and magnetic extractors whose selection depends on the size, shape, material, and location of the foreign body.^{4,7,9} Dental forceps (alligator, shark-tooth and rat-tooth) can be used to pick up flat or thin hard objects. Baskets are used to remove soft foreign bodies because the forceps can cause fragmentation.^{1,7} In this case series, flexible bronchoscopy were successfully removed the foreign bodies with basket instrument. Most extractions of foreign bodies, if performed appropriately, result in minimal complications and mortality. Similarly, there were no significant complications related to the bronchoscopy procedure in our series and patient's clinical condition improved.

4. Conclusion

The diagnosis of FBA can be difficult since the history, physical examination, and chest X-ray are often atypical. Suspicion of aspiration should be considered in those with known risk factors, even in the absence of radiological manifestations. Flexible bronchoscopy is the first choice in the diagnosis and management of foreign body aspiration. All cases showed significant improvement after the foreign bodies were removed.

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