Case Report

Difficult extraction of tracheobronchial peanut foreign body

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ABSTRACT

Background: Tracheobronchial foreign body aspiration is a common emergency case, particularly in children. It happens mostly in children, causing airway obstruction and accidental death. Bronchoscopy is the gold standard of both diagnostics and therapeutics, but despite rapid developments in anesthesia techniques and bronchoscopic instrumentation, airway foreign body extraction is not an easy procedure to perform. **Purpose:** To demonstrate various approaches that can be employed to extract difficult tracheobronchial foreign bodies. **Case report:** This case report presented four cases of difficult extraction of peanut foreign body in the tracheobronchial tract that utilized different approaches of extraction. In all four cases, the foreign body was extracted successfully. **Clinical question:** What are the options available for difficult extraction of tracheobronchial peanut foreign body? **Method:** Evidence-based literatures study about approaches of tracheobronchial foreign body extraction was performed through PubMed, Google Scholar database, and hand searching/e-book. **Result:** A total of 5 relevant articles in pertaining to difficult extraction of tracheobronchial foreign bodies were found. **Conclusion:** There were multiple approaches for extracting tracheobronchial foreign body that could be costumized to each case.

Keywords: tracheobronchial foreign body, peanut foreign body, difficult extraction

ABSTRAK

Latar belakang: *Benda asing traktus trakeobronkial adalah salah satu kasus benda asing tersering pada keadaan gawat darurat. Kondisi tersebut paling sering terjadi pada anak-anak, menyebabkan sumbatan jalan nafas dan kematian. Bronkoskopi merupakan baku emas diagnostik sekaligus terapeutik, , akan tetapi walau telah terjadi perkembangan pesat dalam teknik anestesi dan instrumentasi bronkoskopi, ekstraksi benda asing di jalan napas bukan suatu prosedur yang mudah untuk dilakukan.* ***Tujuan:*** *Memaparkan berbagai pendekatan ekstraksi yang dapat dilakukan pada kasus sulit benda asing trakeobronkial.* ***Laporan kasus:*** *Dipaparkan empat kasus ekstraksi sulit benda asing kacang tanah di saluran trakeobronkial yang menggunakan pendekatan ekstraksi yang berbeda. Pada semua kasus, benda asing berhasil diekstraksi.* ***Pertanyaan klinis:*** *Apa saja pilihan pendekatan yang tersedia pada kasus ekstraksi sulit benda asing kacang trakeobronkial?* ***Metode:*** *Studi literatur berbasis bukti mengenai pendekatan ekstraksi benda asing trakeobronkial dilakukan melalui* PubMed*, basis data* Google Scholar*, dan pencarian manual/*e-book*.* ***Hasil:*** *Didapatkan 5 artikel yang relevan mengenai ekstraksi benda asing trakeobronkial.* ***Kesimpulan:*** *Terdapat beberapa pendekatan yang dapat digunakan untuk mengekstraksi benda asing trakeobronkial, yang dapat disesuaikan dengan masing-masing kasus.*

Kata kunci: *benda asing trakeobronkial, benda asing kacang, ekstraksi sulit*

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INTRODUCTION

Foreign body aspiration is one of the most common otorhinolaryngology emergencies that could lead to airway obstruction, and is one of the leading causes of accidental death in children. It happens mostly in children because of their curiosity, playful nature, immature anatomy, and physiology. Children have tendency to eat while playing, and a habit of placing objects in their mouths as a process of environmental recognition. In addition, the molar teeth in children have not yet fully erupted, and their cognitive abilities as well as its swallowing coordination are still immature.[1,2]

The most common type of foreign body in children are organic foreign bodies such as nuts, beans, lentils, and animal bones. If the foreign bodies enter the tracheobronchial tract, it could lead to obstruction, dyspnea, and even death. Some organic foreign bodies are hygroscopic in nature, they can absorb water and expand, potentially causing total obstruction of the airway.[2]

This paper presented a series of four cases of peanut foreign body in the tracheobronchial tract that each had its difficulties during extraction. The authors aimed to show different approaches that were available to help extract the foreign bodies, adjusting it to the circumstance of each case to successfully extract the foreign body.

CASE REPORT

CASE 1

A 1-year-old boy came referred from a rural hospital with a diagnosis of bronchopneumonia that showed no improvement despite medical treatment. Upon careful history taking, the patient was said to have shortness of breath in the last 3 days before admission after eating peanuts. He was choking and had a violent cough, subsequently he developed abnormal breathing sound.

The patient had an increased respiratory rate, and 97% oxygen saturation with a 10 lpm non-rebreathing mask. There were subcostal retractions with ronchi and wheezing on both llungs. A supine chest x-ray from the previous hospital showed bronchopneumonia with no signs of foreign body. The patient underwent a chest CT scan, which revealed a hypodense lesion in the lower trachea at the level of 4-5th thoracic vertebrae along with bilateral pneumonia as shown in Figure 1.

Bronchoscopy using rigid bronchoscope with general anesthesia was performed on the same day with findings of small nut pieces in the carina. There was a possibility that the patient already chewed the nut, but could not swallow it properly. The peanut pieces had a small diameter of around 2 mm, thus requiring repeated instrumentation, longer procedure duration, and increasing risk of pushing the pieces further inside the bronchi. Grasping of each piece of nut was carried out very carefully and slowly. Evaluation was proceeded to the main bronchus to look for any remaining pieces. Post-operatively, the patient was observed in the pediatric intensive care unit (PICU) and discharged on day 5th with good clinical condition and normal chest examination.

Figure 1. Chest CT-scan showing hypodense lesion in the lower trachea (black arrow)

CASE 2

A 1-year-old girl was brought to the emergency installation because of choking while eating peanut 1 day before admission, followed by difficulty breathing and abnormal breath sounds. Upon auscultation there was ronchi and wheezing on the base of right lung. Chest X-ray showed normal findings with no visible foreign body. A rigid bronchoscopy was done, anda half piece of nut was found on the carina, but the extraction was unsuccessful due to the hygroscopic nature on the nut and the swollen big piece was stuck in the subglottis area. Repeat procedure could not be done due to laryngeal edema (Figure 2a). The patient was then admitted to the PICU. Evaluation using chest X-ray showed atelectasis of right upper lobe of the lung (Figure 2b).

The second attempt to extract the foreign body was performed three days later with a different approach. Tracheostomy was first performed to give access to the trachea. A thin flexible endoscope was inserted to evaluate the location of the foreign body, confirming its location in the trachea. The foreign body was then extracted through the stoma using Hartmann alligator ear forceps under endoscope guidance, and the stoma was sutured and closed. The patient was admitted to PICU for 5 days and discharged with good condition.

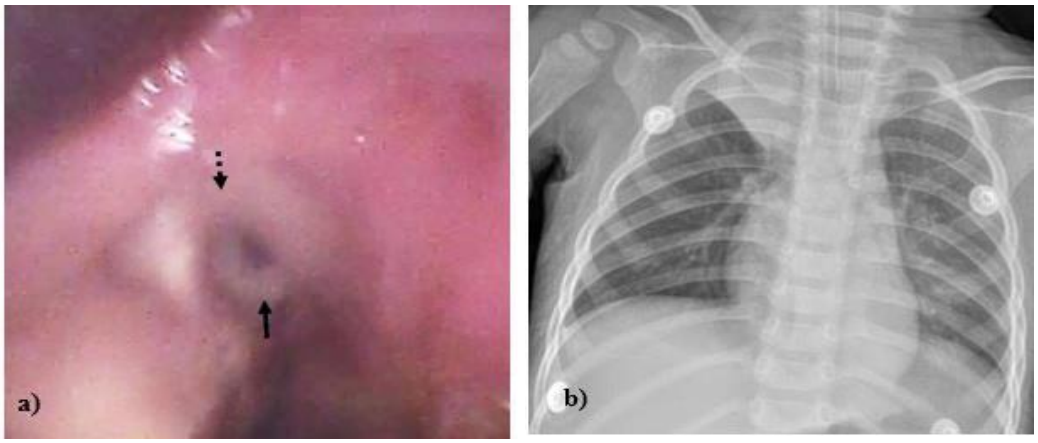

Figure 2. a) Half a piece of nut (black arrow) was stuck in the subglottis area with edematous vocal cord (dotted arrow), b) chest X-ray on day 4 showed atelectasis of right upper lobe of lung

CASE 3

The patient was a 1-year-old boy referred from a rural hospital with suspected peanut foreign body in the airway. The patient choked and coughed while eating peanuts 1 day before admission. The oxygen saturation upon arrival was 92% in room air, and chest retraction was apparent. The breath sound of the right lung was decreased accompanied by wheezing. Chest X-ray showed no apparent pneumonia or signs of foreign body, and CT-scan examination was performed to help confirm the diagnosis. The CT-scan showed an oval-shaped hypodense lesion in the carina.

The patient underwent extraction using rigid bronchoscope, but was unsuccessful. The smallest rigid bronchoscope size 3 (outer diameter of 5mm) was unable to go past the glottis. A flexible bronchoscope with 3.8 mm diameter was used to locate the foreign body. Flexible grasping forceps was inserted through bronchoscope working channel, and used to extract the foreign body. Post-operatively, the patient was admitted to the PICU, and was discharged on day 6th after showing significant clinical improvement.

CASE 4

A 2-year-old boy was rushed to the ER with shortness of breath in the last 5 hours before admission. The parents thought that the complaints arose after the patient ate peanuts whileplaying. He then choked and coughed, followed by shortness of breath and abnormal breath sounds. Upon arrival the patient was anxious and subfebrile, with oxygen saturation of 94% in room air. The lung examination revealed bilateral ronchi and wheezing, with decreased breath sounds of the right lung. Chest X-ray showed bilateral pneumonia with no signs of foreign body. This particular patient came during the COVID-19 pandemic so the possibility of COVID-19 infection needs to be excluded, before any procedure could be taken. During preparation, the dyspnea worsened, and the patient's condition deteriorated rapidly. He had a tonic clonic seizure, was intubated, and then put into PICU. His condition was not fit fortransport to do chest CT-scan, and a portable flexible bronchoscopy was done to confirm the diagnosis of bronchial foreign body. A piece of peanut was found in the right main bronchus.

Extraction using rigid bronchoscope was attempted after the patient's condition stabilized, but was not successful because it was lodged too deep and too slippery for the peanut forceps to grasp. Under those circumstances, we consulted a thoracic surgeon and then a thoracotomy was performed. The peanut was successfully extracted, and the patient's condition greatly improved after the surgery. He was then discharged, and during his follow-up visit, no residual symptoms were found.

CLINICAL QUESTION

Based on the cases presented above, we wanted to identify the management options in patients with peanut tracheobronchial foreign body with the following clinical question: What are the options available for difficult extraction of tracheobronchial peanut foreign body?

REVIEW METHOD

A literature search about approaches of difficult tracheobronchial peanut foreign body extraction was conducted through Medline, PubMed, Google Scholar database, and hand searching/e-book on November 2023 with the keywords "tracheobronchial", AND "peanut", AND "foreign body", AND "extraction".

Inclusion criteria for literature search were: 1) foreign body in the tracheobronchial tract, 2) difficult bronchoscopic extraction, and 3) modifications and adjuncts to bronchoscopic foreign body extraction. Exclusion criteria were: literature regarding other bronchial abnormalities, non-English articles, and articles not available in full text.

RESULT

A total of 5 literatures which were relevant to our clinical question and inclusion criteria were obtained. The literatures were published from 2009-2023.

Table 1. Literature review of selected studies

No.	Authors-Journal	Patient characteristics	Difficulties	Intervention	Outcome
1.	Ding et al. .(2020)[3]	Pediatric patient with tracheobronchial foreign body	Foreign body obstructing airway	Flexible and rigid bronchoscopy, referral to thoracic surgeon	4 unsuccessful extractions subjected to thoracic surgery

2.	Singh et al. .(2009)[7]	Pediatric patients with failed bronchoscopic extraction attempts	Large foreign body, airway obstruction, impaction in the subglottic area	Tracheostomy + bronchoscopy	Successful extraction, no long-term morbidity
3.	Prabakaran et al.(2023)[8]	Pediatric patients with foreign body aspirations, all with respiratory compromise	Large foreign body, glottis and subglottis edema	Tracheostomy + bronchoscopy	Successful extraction of foreign body, stable conditon, tracheostomy decannulation or strapping
4.	Huankang et al. (2012)[9]	Pediatric patients with tracheal and bronchial foreign body	Residual foreign body fragments	Repeat bronchoscopy, referral to thoracic surgeon	More complications in bronchial foreign body. Unsuccessful extraction subjected to thoracic surgery
5.	Boufersaoui et al. (2013)[10]	Pediatric patients with foreign body aspiration	Large, especially inorganic foreign bodies	Rigid bronchoscopy, referral to thoracic surgeon	Successful extraction. Unsuccessful extraction subjected to thoracic surgery

DISCUSSION

Aspiration of foreign body in children is the leading cause of accidental deaths and emergency visits. Tracheobronchial foreign bodies mostly occur in children 1-3 years of age, with choking accounts to 40% of children's death under 1 year old. Children have the tendency to simultaneously play while eating, thus increasing the risk of foreign body aspiration. Organic foreign bodies such as peanuts are the most common foreign body found in children.[1-3] All of our cases were children aged 1-2 years old.

Diagnosis was made from the classic triad of a history of foreign body ingestion, coughing, wheezing, and reduced inspiratory air on auscultation.[2,3] Sometimes the aspiration was not witnessed like in patient 4. Sudden, violent coughs that are followed by wheezing and dyspnea require a high index of suspicion.

More often, early chest X-ray does not help in diagnosing an organic foreign body, especially when performed right after the incidence. A radioopaque foreign body or secondary changes in lung parenchymes will be visible on X-ray. According to Hughes et al.[4], secondary sign involving lung parenchymes are only apparent from day 5. Peanuts are radiolucent, therefore not visible on X-ray, but can often be seen using a CT-scan. Chest X-ray only has a sensitivity of 25% and specificity of 62.5% when compared to CT-scan or bronchoscopy.[5] CT-scan helped to establish the diagnosis in two of our cases, where it could precisely identify the foreign bodies.

Bronchoscopy is the gold standard of tracheobronchial foreign body management as it is both a diagnostic and therapeutic tool. Despite rapid advances in anesthesia

techniques and bronchoscopic instrumentation, airway foreign body extraction is not an easy procedure to perform.[5] In our cases, all patients underwent attempt of rigid bronchoscopy but met with difficulties. Several factors may contribute to unsuccessful extraction, including the size, shape, how long foreign body had stayed in the airway, local changes in the airway, and surgeon's expertise in rigid bronchoscopy.

The first patient had multiple pieces of nuts in the trachea that required repeated extraction, and prolonged instrumentation. According to Lore and Medina[6], the use of bronchoscopic instruments in the airway should not exceed 20 minutes. Prolonged instrumentation is associated with increased complications, which can be minor complications such as pharyngeal mucosal injury, acute laryngitis, hypoxia, bleeding, and fever, as well as major complications such as tension pneumothorax, severe bleeding, severe hypoxia, and heart failure.[1,2,5]

Repeated extraction and prolonged instrumentation can cause airway edema and if extensive edema occurs, second attempt should be postponed for a day or two while administering intravenous corticosteroids to reduce the airway inflammation and edema.[5] The hygroscopic property of peanut can also cause it to expand, making it unable to go through the glottic opening. Different from adults, the narrowest part of the children's airway is the subglottic region at the cricoid cartilage.[1] These were what caused failed extraction in the second patient.

During the repeat attempt, tracheostomy was performed for access and aid in extraction. A study by Singh et al.[7] reported that in patients with airway foreign bodies, 1.2% patients require tracheostomy as an additional procedure to rigid bronchoscopy, to help secure the airway and facilitate the extraction.Prabakaran et al.[8] also reported that tracheostomy combined with bronchoscopy could be a life-saving, easy to perform, and involved removal of foreign body at the same time. Indications of performing tracheostomy in traheobronchial foreign bodies are: foreign bodies located in the subglottic for a long duration, sharp foreign bodies in the subglottic, and foreign bodies larger than the glottic chink. The addition of a tracheostomy procedure was considered safe as there were no mortality, nor long-term complications due to the procedure.[7,8]

Rigid bronchoscopy is still preferred over flexible bronchoscopy especially in children, because it can protect the airway during extraction and have a larger lumen.[9] Flexiblebronchoscopy with smaller diameter was helpful in children with small airway, as in patient 3.

A study done by Boufersaoui et al.[10] in 2624 patients showed successful foreign body removal using rigid bronchoscopy in 97% of patients, and only 3% of patients needed to undergo thoracic surgery. In patient 4, the extraction was unsuccessful due to deeply lodged and hard-to-reach foreign body, thus requiring thoracotomy.

In our hospital, peanut foreign body is more common compared to other types of tracheobronchial foreign bodies. Although the literatures that are currently available showed various types of tracheobronchial foreign body, but the methods of extraction as a modification or adjuncts to bronchoscopic extraction could be performed in our case nonetheless. In our case report, all four patients showed satisfactory results and recovered without sequelae or complications.

In conclusion, tracheobronchial foreign body is an emergency that could lead to airway obstruction and death in children. Diagnosis is made from history of foreign body ingestion, clinical symptoms, and confirmed using bronchoscopy. Although bronchoscopy is the gold standard for both diagnostics and therapeutics, it sometimes is not easy to perform due to several difficulties

during extraction, requiring repeated attempt and/or other methods for successful extraction. In smaller children with small airway diameter, and in case of airway edema or large foreign body, tracheostomy should beconsidered as an access for extraction. It is important to give attention to airway condition and instrumentation time, especially in cases that require repeated attempts. Consultation to thoracic surgeon for thoracotomy should be done immediately, in the case of failed attempts and foreign body that are difficult to reach.

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