Case Report

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# MANAGEMENT OF ANESTHESIA IN PEDIATRIC PATIENTS WITH BRONCHOSCOPY LATE ONSET FOREIGN BODY ASPIRATION

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## ABSTRACT

**Introduction:** Aspiration of foreign bodies in the airways is a severe and fatal condition if it occurs in children, because the risk of life-threatening obstruction is higher. Bronchoscopy is the main choice of procedure for treating foreign body aspiration, either with rigid bronchoscopy or flexible bronchoscopy. Anesthesia techniques are used with comprehensive anesthesia considerations, such as premedication, induction of anesthesia, maintenance of anesthesia, and monitoring.
**Objective**: To evaluate the management of anesthesia in a pediatric patient with foreign body aspiration in late-onset settings.
**Case report:** We report a case of anesthesia management in a child who aspirated a foreign body (peanuts) three days before being delivered to the hospital and undergoing a rigid bronchoscopy procedure. The patient experienced respiratory failure, and atelectasis was found in the right lower lobe of the lung upon arrival at the Emergency Unit (ER) due to the late onset of the case, so a secure airway must be performed before rigid bronchoscopy. Post-treatment care is carried out by observation and monitoring in the Intensive Care Unit (ICU) with complications of pneumonia. After three days of ICU treatment, the patient was transferred to the High Care Unit (HCU) in improved condition. The patient was discharged after three days of treatment in the low care Unit.
**Conclusion:** Rigid bronchoscopy is the best modality for extracting foreign bodies in the pediatric airway. Delayed onset effects from foreign body aspiration in the respiratory tract cause greater complications after bronchoscopy. Pneumonia is the most common complication. Comprehensive anesthesia evaluation and preparation are the keys to the success of this procedure.

**Keyword:** Anesthesia management; Bronchoscopy; Foreign body aspiration in children's airway; Intensive care unit

## ABSTRAK

**Pendahuluan:** Aspirasi benda asing dalam saluran napas merupakan kondisi yang sangat serius dan fatal apabila terjadi pada anak-anak, karena risiko kematian akan lebih tinggi akibat obstruksi total saluran napas. Bronkoskopi merupakan pilihan utama dalam penanganan aspirasi benda asing, baik dengan bronkoskopi rigid maupun bronkoskopi fleksibel. Teknik anestesi yang digunakan dengan pertimbangan anestesi komprehensif, seperti premedikasi, induksi anestesi, rumatan anestesi, dan monitoring**.**
**Tujuan:** Untuk mengevaluasi manajemen anestesi pada pasien pediatri yang mengalami aspirasi benda asing dalam fase onset lambat.
**Kasus:** Tindakan anestesi pada anak yang mengalami aspirasi benda asing (kacang tanah) sejak 3 hari sebelum dibawa ke rumah sakit dan dilakukan tindakan bronkoskopi rigid. Pasien mengalami gagal nafas dan sudah didapatkan atelektasis pada lobus inferior paru kanan saat tiba di Unit Gawat Darurat (UGD) akibat late onset dari kasus tersebut sehingga harus dilakukan secure airway sebelum dilakukan tindakan bronkoskopi rigid. Perawatan pasca tindakan dilakukan observasi dan monitoring di *Intensive Care Unit* (ICU) dengan komplikasi Pneumonia. Pasca tiga hari perawatan ICU, pasien dipindahkan ke *High Care Unit* (HCU) dengan kondisi perbaikan. Pasien dipulangkan setelah perawatan *low care* Unit selama tiga hari terakhir.
**Kesimpulan:** bronkoskopi rigid merupakan modalitas terbaik pada tindakan ekstraksi benda asing pada saluran nafas anak. Adanya efek *delayed* onset dari aspirasi benda asing di saluran nafas menimbulkan komplikasi pasca tindakan bronkoskopi lebih besar. Pneumonia merupakan komplikasi yang paling sering terjadi. Evaluasi dan persiapan Anestesi yang komprehensif merupakan kunci keberhasilan prosedur ini.

**Kata kunci:** Tindakan anestesi, Rigid Bronkoskopi, Aspirasi benda asing pada saluran napas anak; *Intensive Care Unit*

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## INTRODUCTION

Foreign body aspiration is a serious and potentially lethal condition resulting from the entry of a foreign object into the airway. The symptoms that arise depend on the grade of airway obstruction. Death is a complication of foreign body aspiration that obstructs the airway. Foreign body (FB) aspiration is a common and serious problem in childhood, as it requires early recognition and treatment to avoid potentially fatal consequences. Foreign body aspiration could occur at any age, but it is more common in children. In adults, the incidence of foreign airway aspiration is related to conditions of decreased consciousness. Suspecting a foreign body and getting a satisfactory medical history are the most important steps in foreign body aspiration. Bronchoscopy is the main choice in treating foreign body aspiration. This procedure can be performed using flexible bronchoscopy or rigid bronchoscopy. Rigid bronchoscopy is the main choice for aspiration extraction of foreign bodies in children (1–3).

Rigid bronchoscopy is used to evaluate the upper and lower airways. This assessment is useful for diagnosis and for therapeutic purposes. Complications caused by foreign objects in the airways can also arise from bronchoscopy, which is considered iatrogenic. Apart from that, aspiration of foreign objects in the airways is influenced by 3 things, there are geographical conditions, food variations, and environmental conditions. The most common aspiration of foreign bodies in the airways in children is peanut aspiration. In previous research, it was noted that at the age of 0-3 years, 50% of foreign body aspirations occurred, while at the age of 4-15 years, the incidence of foreign body aspiration occurred in the range of 75-85%. This is different from adults, the incidence of foreign body aspiration often occurs at old age (geriatric populations), and the number of males is greater than that of females (ratio 2:1). The cause of the high rate of foreign body aspiration in children is because of the tendency to put everything into their mouths, because children often cry, scream, and run around with food in their mouths, and also because the molar teeth in children have not yet formed, so the chewing process is not yet complete, and poor swallowing and easy aspiration into the airway in children (4–6).

### Airway Anatomy

Anatomically, the respiratory system consists of the upper respiratory tract, consisting of the nose, pharynx, and larynx, and the lower respiratory tract, consisting of the trachea, bronchi, bronchioles, alveolar ducts, and alveoli. The pharynx is a tube-like channel 12.5 cm long that connects the posterior nasal cavity and oral cavity to the esophagus and larynx. The larynx is where the vocal cords are located below the epiglottis. During the swallowing process, the posterior part of the tongue together with the upper part of the larynx is pushed upwards, making the epiglottis close to prevent food or foreign objects from entering the larynx, however, if a foreign object enters the larynx and hits the vocal cords, a cough reflex will arise to expel the foreign object (7).

The trachea is a tube 11-14 cm long that connects the cricoid cartilage in the larynx with the primary bronchus. In the anterior part the trachea is formed from C-shaped cartilage and in the posterior part by muscle and connective tissue with a flat surface. The diameter of the trachea in adult males is 1.3-2.5 cm, while in adult females it is around 1.0-2.1 cm and consists of 16-20 tracheal rings. The tracheal ring functions to prevent the trachea from collapsing and plays a role in the flexibility of movement in the neck. The trachea then continues into the right main bronchus, which is wider, shorter (2.2 cm), and more vertical than the left main bronchus (5 cm), thereby increasing the opportunity for foreign objects to enter the main bronchial airway, especially the right main bronchus. The anatomy of the right main bronchus is divided into several subdivisions, namely 3 branching lobes, and then the

left main bronchus is divided into several subdivisions, branching into two lobes (8).

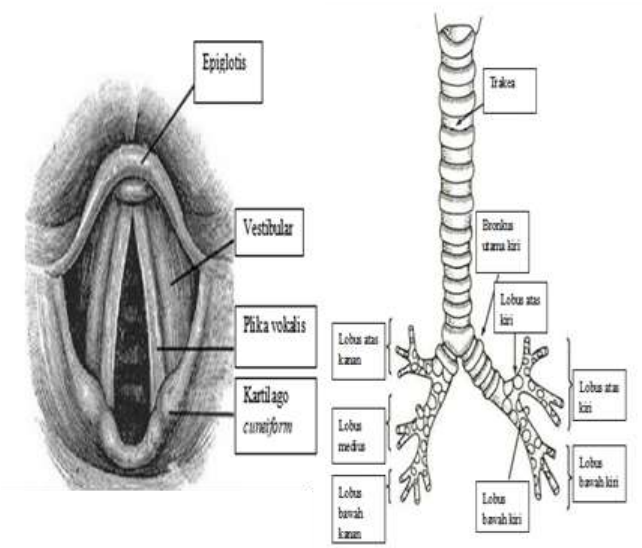


**Figure 1.** Larynx and Trachea (8)

**Diagnosis of Foreign Body Aspiration**

The diagnosis of foreign body aspiration in children is not easy, patients often do not remember a history of choking due to a foreign body. In Rodriguez et al.'s (9) research, it was found that 6 out of 14 patients who experienced aspiration of metallic foreign bodies experienced a delay in diagnosis of more than 30 days. Posteroanterior (PA) and lateral chest x-rays are performed to evaluate the soft tissue of the neck area as an initial modality for suspected aspiration of foreign bodies in the upper airway. According to research by Pinto et al. (10), chest X-ray examination can identify foreign body aspiration in only 22.6% of cases, because the identification of the location of a foreign body depends on the material of the foreign body. And the chest X-ray image can be normal within the first 24 hours after the history of aspiration because that newest study by Wang et al. (11) stated a chest CT scan is the highest rate sensitivity to confirm the diagnosis of foreign body airway obstruction.

Computed tomography (CT) is the gold standard and more sensitive for identifying foreign bodies. According to Wang et al. (11), CT-guided bronchoscopy has a sensitivity of 100% and a specificity of 75% in identifying foreign bodies. The clinical symptoms of foreign body aspiration depend on the location of the obstruction caused by the foreign body. If obstruction occurs in the larynx, symptoms of choking will appear with hoarseness, aphonia, and cyanosis and even death. Obstruction in the trachea can cause stridor and coughing, while obstruction in the bronchi can cause symptoms of coughing, wheezing, hemoptysis, shortness of breath, chest pain, and decreased breath sounds but can also be normal on physical examination. When diagnosis is delayed, the period between aspiration and the onset of worsening symptoms depends on airway obstruction and foreign body material (organic or inorganic) (8,12).

Foreign objects enter the airway when the larynx is open or when aspiration occurs. A foreign object that enters the airway will cause a cough reflex, then symptoms will appear according to the location, size of the obstruction, and length of time the foreign object has been in the airway. Foreign objects that enter the airways will cause a reaction in the surrounding tissue. The resulting reactions can include local inflammation, airway oedema, ulceration and the formation of granulation tissue, which can result in airway obstruction. As a result of this obstruction, air trapping, emphysema, atelectasis, lung abscess and bronchiectasis will occur in the distal part of the airway obstruction. Reduced mucociliary movement will cause a buildup of secretions resulting in atelectasis. The local inflammatory reaction causes oedema and increased airway mucoid secretions. If an infection occurs, it can cause the formation of pus and granulation tissue in the airways (4,13–15).

Peanuts are hygroscopic organic foreign bodies that are soft and often swell with water and cause irritation to the respiratory tract mucosa. This condition can cause severe inflammation of the airways and initiate the formation of airway granulation tissue. The reaction took place quickly. Apart from that, peanuts in the tracheobronchial airway can cause moderate to severe respiratory tract infections known as arachidic bronchitis. Typical

symptoms that appear after 24 hours are a cough with purulent phlegm accompanied by fever. Other symptoms are choking in 85%, coughing in 57%, and airway obstruction in 5%, while on physical examination you will find wheezing breath sounds in 40%, decreased breath sounds in the side with the foreign object in 10%, and asymptomatic in 40%, but if there is total obstruction in the airway, main breath will cause cyanosis (16–18).

A study conducted by Shlizerman et al. (19), regarding the effects of delayed diagnosis and treatment due to late-onset symptoms of misdiagnosis from aspiration of foreign bodies in the respiratory tract found pneumonia and atelectasis. Another study by Rance et al. (20), found that the most common late complications are bronchial stenosis and bronchiectasis, but only a few patients need surgical intervention.

**Management of Foreign Body Aspiration**

The principle of managing airway foreign body aspiration is to remove the foreign object immediately under minimal conditions and trauma. Foreign objects in the bronchus can be removed using rigid bronchoscopy or flexible bronchoscopy. The success rate is 91.3% in infants and children with relatively small airway diameters, it is better to use rigid bronchoscopy so that it can maintain airway patency. Before carrying out a bronchoscopy procedure, what to know is to visualize the object using chest x-ray radiology imaging, then determine the diameter of the scope, which is adjusted to the diameter of the child's tracheobronchi. After that, steroids and antibiotics are given before action is taken as prophylaxis against infection and complications of airway oedema, especially in cases that are treated late (14,17).

Rigid bronchoscopy, as the name suggests, uses a rigid material in the form of a metal tube with a lighting source proximal to the scope. The diameter and length of the metal tube vary according to the cross-section of the bronchus to be examined. Rigid bronchoscopy is chosen in pediatric cases such as massive hemoptysis, lung abscess, bronchial obstruction with thick secretions, narrow trachea, and foreign objects in the trachea or bronchus. The advantages of choosing this procedure are that breathing is more controlled, the lighting quality is better and the lumen is larger, making it easier to see the airways more clearly. Besides that, it can handle massive airway bleeding better and the process of removing foreign objects is easier (17).

**Table 1.** Size of bronchoscope according to age (17)

| Age | Size |
|---|---|
| **Premature** | 3 mm x 20 cm |
| **Infant** | 3.5 mm x 25 cm |
| **3-6 months** | 3.5 mm x 30 cm |
| **12 months** | 4 mm x 30 cm |
| **2 years** | 4 mm x 30 cm |
| **4 years** | 5 mm x 35 cm |
| **5-7 years** | 5 mm x 35 cm |
| **8-12 years** | 6 mm x 35 cm<br>7 mm x 40 cm |

**Figure 2.** Rigid bronchoscopy (21)

**Anesthesia management**

Both rigid and flexible bronchoscopy procedures require special skills from anesthesiologists as well as bronchoscopy operators. The difficulty is due to the anesthesia and the intervention being performed on the airway. Both actions work on the airway, therefore maneuvers are needed to maintain the airway by maintaining oxygenation and iavoiding hypoxemia. Several ventilation options can be used and vary from nasal

cannulas and masks to LMA (laryngeal mask airway) and endotracheal tube (ET/endotracheal tube), each of which has advantages and disadvantages (22,23).

**Pre-Anesthesia Evaluation**

Bronchoscopy performed under general anesthesia requires standard preoperative assessment. Patients must be examined and it must be determined which physical status category they fall into according to the American Society of Anesthesiologists (ASA). Preoperative assessment is the same as for patients undergoing surgery and consists of serial physical examination, basic laboratory, and coagulation tests. Pulmonary function tests must be performed on patients who have severe respiratory obstruction, and CT scans need to be carried out on hemoptoe patients, especially those suspected of suffering from malignancy. Blood gas examinations are carried out for evaluation in several patients with the aim of determining hypokalemia or hypercarbia. Pay particular attention to the anesthesiologists on the patient's mouth opening, jaw, and neck movements. Patients who already suffer from dyspnoea and require oxygen or are hemodynamically unstable are at high risk of intra and postoperative complications (4). When a foreign body is suspected in the airway, preoperative assessment must include several things (24–26):

a) The location of the foreign object: if it is in the trachea, there is a risk of total obstruction, and it is best to take immediate action in the operating room.
b) Aspirated materials: Organic materials can absorb fluid and swell, oils from nuts can cause local inflammation, and sharp objects can cause injury to the airway.
c) Aspiration time: Airway oedema, connective tissue granulation and infection can complicate the extraction.
d) When the last meal was taken must be known to avoid the risk of further aspiration.
e) Airway patency must be controlled.

When the aspirated foreign body does not cause distal airway obstruction or causes minimal lower tract airway obstruction, the physician still has time to complete other preparations for bronchoscopy and prepare the patient to be fasted. The optimal fasting time is 4 to 6 hours for solid foods and 2 hours for clear liquids. Fasting is mandatory to reduce the risk of farther aspiration because, during the procedure, the airway cannot be fully protected (22–27).

**Premedication**

The topical anesthesia is hand-nebulized lidocaine and lidocaine jelly as a lubricant, as well as instillation of 3 ml of 1% or 2% lidocaine in the carina and if necessary, into the lower respiratory tract, with a maximum lidocaine dose of 45 mg/kg. Midazolam is given by dose titration to produce mild sedation, the total dose should not be more than 20 mg. The patient's clinical condition, analgesia drugs, or muscle relaxant drugs determine the type and level of sedation achieved by titrating the sedation dose in rigid and flexible bronchoscopy procedures to maintain oxygenation and prevent the patient from resisting the ventilator. Synthetic narcotics, such as fentanyl, suppress coughing and provide sufficient analgesia. Other sedations, such as benzodiazepines or propofol, can also be used, while light sedation can also be given to patients using topical anesthesia or using lignocaine injections during rigid bronchoscopy or flexible bronchoscopy procedures. Premedication generally uses anti-sialogue drugs (atropine injection 10 mcg/kg body weight intramuscularly), benzodiazepines (midazolam 0.05-0.07 mg/kg body weight intravenously), and bronchodilators (22–24).

**Monitoring**

Pediatric patients undergoing a bronchoscopy procedure are being monitored in the same way as other anesthesia procedures under general anesthesia. Special consideration should be given to pulse oximetry monitoring, which will show

desaturation percentage before clinical signs appear (skin color and others). In addition, the rate of change in saturation provides hints as to how the patient tolerates apnoeic episodes. Blood gas analysis (BGA) provides an inconclusive estimate of end-tidal $pCO_2$ levels, because most of the aspirated gas comes out from around the bronchoscopy scope. Intraoperative monitoring uses standard monitors, including electrocardiography (ECG), pulse oximetry, and non-invasive blood pressure (NIBP) (28).

**Induction of anesthesia**

Induction of anesthesia through the inhalation or intravenous route for rigid bronchoscopy or flexible bronchoscopy for aspiration of a foreign body, however, operators prefer to use rigid bronchoscopy, especially in children. Anesthesia induction is based on the protocol of each educational or training institution, but the basic principle is that spontaneous ventilation must be maintained until it is clear that the pediatric patient can be ventilated well. Anesthesia induction is based on the protocol of each educational or training institution, but the basic principle is that spontaneous ventilation must be maintained until it is clear that the pediatric patient can be ventilated well. Based on research, intravenous induction has a higher risk of aspiration outcomes than inhalation induction.

A survey from the Society for Pediatric Anesthesia found that the majority of anesthesiologists prefer mask induction without cricoid compression for pediatric patients with foreign body aspiration. In this case, the anesthesiologist also prefers to use induction with an inhalation anesthetic, such as sevoflurane. Other Studies indicate that sevoflurane has fewer side effects compared to halothane when used for induction in pediatric bronchoscopy cases. Another induction option for bronchoscopy is the topical application of lidocaine spray to the vocal cords and trachea. The advantage of using lidocaine spray is that the volume used is larger with a short duration of around 10 minutes, and the dose is 4 mg/kg, which has been proven to have no complications in pediatric patients, but it is necessary to reduce the dose given to children aged < 2 years and in patients who have dry mucosa. The ideal type of anesthesia for extracting foreign bodies from the airway is a combination of hypnosis, analgesia, and muscle relaxation. The drugs used include propofol, etomidate, or ketamine along with fentanyl or remifentanil. Fentanyl boluses and short-acting beta-blockers may be used to avoid the pain response. Plica vocalis with topical anesthesia lignocaine 4% can be used to avoid postoperative laryngospasm (24).

**Anesthesia Maintenance**

Anesthesia is maintained with remifentanil or propofol, continuous inhalation agents. The use of $NO_2$ is still contraindicated in air-trapping patients because of the high risk of excessive lung air inflation. Deep sedation is also used but still carries the risk of hypoventilation and laryngospasm. Ventilation in patients with rigid bronchoscopy is a challenge for all anesthesiologists, most patients who undergo bronchoscopy have abnormal lung function. Therefore, special techniques and strategies are needed to ventilate patients, such as spontaneous assisted ventilation, controlled ventilation, manual jet ventilation, and high-frequency jet ventilation. Preoxygenation aims to denitrogenate with 100% oxygen and relax muscles using short-acting muscle relaxants. The oropharynx is closed with gauze around the rigid bronchoscope. Spontaneous assisted ventilation typically employs total intravenous analgesia (TIVA), while oxygenation is provided through bronchoscopy. Oxygenation is provided via bronchoscopy, and ventilation assistance is provided. Anesthesia was maintained with continuous intravenous medication. Controlled ventilation in bronchoscopy is used in conjunction with an endotracheal tube for positive ventilation, while for jet ventilation high-pressure gas is used using a small catheter (25).

**Complication**

One of the fatal complications of removing a foreign object from the airway is airway obstruction caused by unpredictable movement of the foreign object in the airway. This can occur if the foreign object falls or breaks apart towards the proximal part of the airway. The treatment for this condition involves pressing the foreign object into the distal part of one of the main bronchi in the airway. Several case reports suggest that the type of ventilation has little effect on the incidence of complications compared with the skill of the operator and the bronchoscopy equipment used. Repeated manipulation of rigid bronchoscopy can cause trauma to the gums and vocal folds. Laceration until perforation of the airway can occur in the posterior wall of the trachea, posterior subglottis, and medial wall of the left or right main bronchus just below the carina. Lacerations of the vocal folds and the anterior wall may also occur, leading to bleeding. The bleeding that occurs can be treated with cauterization and local compression with a scope added with epinephrine. If the bleeding is > 250 ml, an emergency thoracotomy is required. Another event that may occur is a fire or explosion, so in this condition, immediate action is needed, stopping ventilation and removing the oxygen source, while air embolism can also occur due to the connection between the airways and blood vessels (26).

**Recovery**

In most cases of airway foreign body extraction without complications, the patient can be sent home immediately (one-day care). However, in severe cases, longer treatment may be needed if complications occur during the bronchoscopy procedure by administering antibiotic treatment to treat infections due to delays and handling cases of airway foreign body extraction. After the bronchoscopy procedure, it is recommended to maintain the patient's temperature optimally and monitor for signs of respiratory distress in the recovery room. What must be considered is whether the patient is completely conscious before being moved to the recovery room after being given general anesthesia during the bronchoscopy procedure. If the patient is desaturated and there are blood and mucous secretions in the airway, then ET must be observed and maintained. After leaving the operating theater, a bronchodilator agent is needed to be administered to prevent bronchospasm after the bronchoscopy procedure (28). The objective of this study is to evaluate the management of anesthesia in pediatric patient with foreign body aspiration in late-onset settings.

**CASE REPORT**

A 7-month-old boy weighing 10 kg came to the P1 Emergency Room at Saiful Anwar General Hospital Malang, presenting with shortness of breath. According to the patient's history, he exhibited signs of shortness of breath for the last 3 days before being admitted to the hospital, which worsened after one day in the hospital. Previously, the patient inhaled peanuts while playing alone next to his mother, who was preparing them. Shortly after being inhaled, the patient appeared to be coughing continuously. He tried to expel it using his hands but the cough persisted. The patient was then taken to the Ear, Nose, and Throat (ENT) polyclinic in Situbondo City and advised to refer immediately to Saiful Anwar General Hospital for further treatment. The patient was referred to Saiful Anwar General Hospital on the day of the incident, but the patient's mother refused to undergo surgery at that time, and the patient was taken home, but the patient got worse and the patient's mother decided to take him back to Saiful Anwar General Hospital.

Physical examination showed results, increased heart rate (HR) 164 x/min and respiration rate (RR) 36 x/min with Non-Rebreathing Mask (NRM) $SpO_2$ 100%. Suprasternal, intercostal, and supraclavicular retraction, but was presented without gargling or stridor signs.

**Figure 3.** A pre-surgery chest X-ray shows signs of right lower lobe atelectasis

From the results of the history taking, physical examination, and radiological examinations, the patient was diagnosed with a foreign body (peanut) in the right bronchus with respiratory distress. The patient was then referred to the Anesthesia Department by the ENT department for an immediate exploratory bronchoscopy. A secure airway procedure was carried out with direct intubation in the emergency room using 25 mcg of fentanyl, 30 mg of propofol given by titration, and 5 mg of atracurium due to the threat of respiratory failure. Once the airway condition is safe, the patient is immediately taken to the emergency operating room for further procedures.

The patient is treated with general anesthesia (GA) via endotracheal tube (ETT) for approximately 1 hour from preparation for anesthesia until the patient has finished the procedure. During the procedure, maintenance was given an additional 20 mcg fentanyl and 5 mg atracurium with 2% sevoflurane dial anesthetic gas.

The patient was positioned to sleep on his back after anesthesia, and his head was positioned to sleep hyperextended by the ENT team. Then the bronchoscopy scope was inserted, and a round, brownish foreign body was seen in the right bronchus. Extraction was carried out using teleforceps, and 6 peanut fragments were obtained. After the fragments were removed, an evaluation was carried out on the trachea to the right and left bronchi and no remaining corporal fragments were found, only secretions were found without any lacerations. After suctioning and ensuring that the secretions are clean, the bronchoscopy scope is removed.

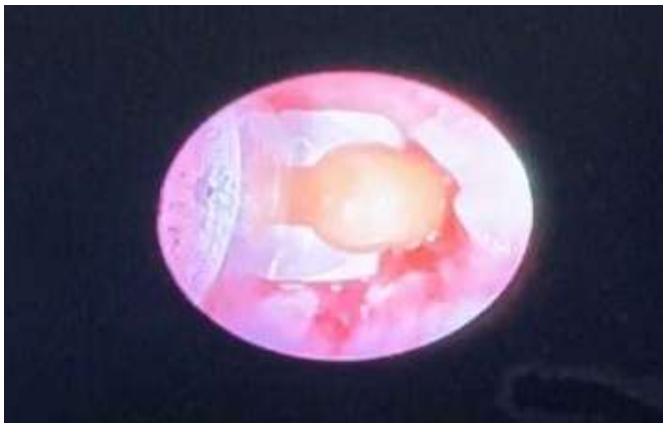

**Figure 4.** Roundish brownish foreign body in left bronchus (picture taken from bronchoscopy video)

For postoperative care, the patient is admitted to the tube-in Intensive Care Unit (ICU) for further observation and monitoring. The patient was treated in the ICU for 2 days, and the condition showed an improvement. During ICU treatment, the patient received intravenous therapy with ampicillin sulbactam 4x375 mg, dexamethasone 3x2 mg, ranitidin 2x10 mg, and metamizole 4x10 mg. Oral medication was also given such as NAC 2x100mg and Ventolin nebulization every 8 hours. The patient was decided to be extubate on the second day after the procedure, and his condition was stable during treatment 24 hours after extubation.

The patient was transferred to the High Care Unit (HCU) on the fourth day after the procedure. During 24 hours of HCU treatment, the patient had no complaints, then he was transferred to a low-care room and discharged three days later.

## DISCUSSION

One case of aspiration of a foreign object (peanut) in the right main bronchus in a 7-month-old boy has been reported. This case is by various

literature that the incidence of foreign body aspiration is 75-85% in children aged <15 years and 50% in children aged <3 years (5,6). Children with immature molar teeth and immature swallowing coordination and crying conditions are factors that cause foreign body aspiration in this case. In this case the foreign object that was aspirated was peanuts. Based on the results of the study, it was stated that peanuts were the most common cause of around 52.3% of aspiration of foreign objects in the respiratory tract, followed by other foods (12.2%), other grains (5.3%), bones (1.5%), plastic materials (15.1%), metals (4.5%), small stones (0.8%), and tablets (1.2%) (5,6,29).

The peanut foreign body in this patient had been lodged for 6 days. The patient was taken to the hospital on the third day after aspiration, but the family refused the bronchoscopy procedure, however, the patient came back 3 days later in worsening condition, with symptoms like severe shortness of breath and loss of consciousness.

The findings on bronchoscopy were an inflammatory reaction in the respiratory tract, the mucosa appeared hyperemic with thick secretions covering the peanuts, where the peanuts did not contain skin and that was why the peanuts expanded easily because they were hygroscopic. The patient in this case was also given corticosteroids (dexamethasone) 6 hours before the bronchoscopy procedure and was also given during the bronchoscopy procedure. Apart from that, this patient was also given antibiotics because this patient was a case of late bronchoscopy due to a neglected family who did not agree to the procedure, so to reduce oedema and the risk of serious infection, adequate antibiotics were needed. The Pediatric Acute Lung Injury Consensus Conference (PALICC) guideline does not recommend the routine use of corticosteroids for pediatrics with acute respiratory distress syndrome (ARDS), however research conducted by Fernandez et al. (30) in 2018 shows that this is still controversial. A Randomized Controlled Trial (RCT) pilot study by Drago BB et al. (31) on 35 pediatric patients with ARDS. Patients receiving steroids compared to the group of patients receiving placebo within the first 72 hours of mechanical ventilation at a dose of 2 mg/kg/day and tapering off after 7 days were said to have had better results, especially in population groups with a history of asthma, pneumocystis pneumonia, and chronic obstructive pulmonary disease.

The diagnosis of a foreign body in the airway was only made after 3 days when the patient aspirated peanuts, as the patient was taken to the hospital after this delay. Therefore, there was no delay in determining the diagnosis itself; rather, the cause of the delayed diagnosis stemmed from the prolonged timing of the patient's visit and subsequent delays in performing the bronchoscopy procedure. The peanut extraction procedure with the bronchoscopy procedure was delayed for up to 6 days, not because of the negligence of the bronchoscopy team, but because of the family's inability to carry out the procedure at the beginning of the first visit, in fact it gave the impression that the family was delaying the bronchoscopy procedure for reasons that were not yet clear. According to ding et al.'s study, the diagnosis of foreign body aspiration can be made within 0-1 days (45%), 2-7 days (22%), 7-30 days (14%), and >30 days (17%). This shows that the percentage of early diagnoses is higher, and it is possible that earlier diagnoses can be made with a better prognosis, which also depends on the clinician's experience in establishing the diagnosis (20,30).

A chest x-ray examination at the first visit of this patient revealed an abnormality in the form of right lower lobe atelectasis with a picture of homogeneous right paracardial opacity that pulled the right diaphragm, indicating that there was an almost total blockage in the right lower bronchial segment. When compared with the second patient's chest x-ray 24 hours after the procedure, it was found that the chest x-ray picture of pneumonia (new process), right upper lobe atelectasis (new

lesion), and lower lobe atelectasis was relatively the same as the previous chest x-ray picture, so it can be concluded that the patient experienced disease progression due to peanut aspiration, because a delay in bronchoscopy treatment caused blockage in other lung lobes and lung infection could not be avoided.

In this patient, rigid bronchoscopy was performed for a definite diagnosis and at the same time evacuation of the foreign object (peanut). Rigid bronchoscopy is the best modality for airway foreign body extraction in children, with the advantages of ensuring airway patency and clear visualization of the airway. The difficulty in extracting peanuts in this patient is the deep location and narrower diameter of the airways accompanied by purulent secretions covering the peanuts so that extraction is done more than once because they are slippery. Then the bronchoscopy procedure took more than 20 minutes because of this. The theory states that bronchoscopy should take less than 20 minutes to avoid complications. The complications that occur are divided into 2, such as minor complications (mucosal injuries: pharyngitis, acute laryngitis, hypoxia, fever and mild-moderate bleeding) and major complications (tension pneumothorax, severe bleeding, severe hypoxia, and heart failure). From the results of examinations and observations before and during the procedure, as well as after the bronchoscopy procedure, no serious complications were found in this patient (5,6,12).

In patients with severe conditions and late-onset treatment, endotracheal intubation with a tidal volume of 5-8 ml/kg with a PEEP >15 cm $H_2O$ is recommended, taking into account the clinical characteristics of patients on mechanical ventilation. To maximize ventilation and oxygenation, the guidelines recommend administering sedation and a combination with muscle relaxants while still paying attention to the patient's nutritional coverage and fluid management, the same as patients in critical conditions in other ICUs. Management of atelectasis by adjusting ventilator settings and treating pneumonia according to the guidelines results in an improvement in the patient's condition (5,20,28).

One of the main limitations of this case report is its inherent lack of generalizability, as it describes the anesthetic management of a single pediatric patient with late-onset foreign body aspiration. While the case provides valuable insights into clinical decision-making, including preoperative assessment, induction technique, and airway management strategies, the findings cannot be universally applied to all similar cases due to variations in patient anatomy, type and location of the foreign body, and institutional resources.

## CONCLUSION

Foreign body aspiration is a serious condition that can potentially be fatal. Bronchoscopy is the main choice for the extraction of foreign bodies, it can be done with rigid bronchoscopy or flexible bronchoscopy. It is recommended that a highly experienced team be available for foreign body aspiration cases, especially in paediatric patients.

Good anesthetic management, evaluation, and preparation, including patient history, comorbidity, and preexisting lung infection before the procedure are key elements for the successful management of this problem. Anesthesia agents for premedication, induction, and inhalation maintenance during the procedure had to be chosen carefully and based on patient selection, especially in pediatric patients. Further research with serial cases is needed to evaluate standard anesthesia drugs for the pediatric bronchoscopy procedure.

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## Conflict of interest

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**Patient Consent for Publication**
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**Author contribution**
RS contributes to the study concept or design, data collection and writing the paper. RV contributes in the study concept or design, data collection, analysis and interpretation, oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.

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