Bronchial foreign body: a disease that should not be ignored

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Abstract

Objects: This study aimed to analyze the clinical manifestations, sources, and treatment methods used in patients with a bronchial foreign body.

Methods: We analyzed the basic characteristics, clinical signs, CT imaging presentations, pathological manifestations, pathological biopsy results, fiberoptic bronchoscopic surgical techniques, and interventional therapeutic approaches in seven patients with a bronchial foreign body.

Results: Among the seven patients with a bronchial foreign body, there were three males and four females. Of the patients, five patients were over 50 years old. Duration of time since onset varied, ranging between six hours and 30 days. One patient had finger pulse oxygen saturation below 90%. Foreign body was the cause of presentation in all seven cases. Computed tomographic scans were normal in one patient, one patient showed a left lung disease, and five patients showed a right lung disease. The presence of the foreign body could be seen in only one patient. Pathological biopsies identified a chili peel in one case, a duck bone in one case, a tooth in one case, and peanuts in three cases. In the seventh patient, a pen cap was found without a pathological biopsy. Using fiberoptic bronchoscopy, the foreign bodies were found and removed in all patients. We also performed bronchial stenosis in three patient, bronchial stenosis with granulation tissue formation in two patients.

Conclusion: Neglected foreign bodies in the bronchi could cause various complications and seriously affect the patient's health.

Introduction

Bronchial foreign bodies are often caused by inadvertent aspiration or while laughing, during general anesthesia, by aspiration of vomitus or dentures in comatose patients, due to mental illness, or in an attempted suicide\(^1,2\). Vigorous coughing often occurs when a foreign body passes the glottis and enters the trachea. Some patients show short-term belching and might turn pale blue\(^3\). If a foreign body is embedded in the glottis, hoarseness and breathing difficulties might occur, and in severe cases even suffocation. When a foreign body enters the trachea or bronchi, it normally stays in a certain place and the irritation is reduced. At this time, the patient might have a slight cough with no
other symptoms, and the incident associated with the inhaled foreign body might be forgotten. The inhaled foreign body is thus often ignored. Besides, when a foreign body localizes, it stimulates a reaction and causes secondary inflammation. The trachea and bronchial tubes will become aggravated, local granulation tissue will proliferate, and the affected trachea or bronchus will narrow gradually. Sputum will not get cleared smoothly, and respiratory failure, pneumonia, atelectasis, and lung abscess might develop. If the foreign body is not removed in time, it will affect the patient's health, and in severe cases, the patients might die from it. Therefore, a bronchial foreign body is a disease that should not be ignored.

When a bronchial foreign body is found, bronchoscopy is often used in clinical practice to remove it. Removal methods include clamp surgery, argon freezing surgery, and snare surgery. For foreign bodies that cannot be removed through the mouth, open chest surgery is needed. It is best, however, to avoid this method when possible. If a foreign body causes granulation or narrowing of the trachea or bronchus, the patient should be treated by bronchial intervention, using surgical techniques such as argon gas knife, freezing, stent placement, balloon dilatation, or high-frequency electric knife. The purpose of this study was to analyze the clinical symptoms, nature, and treatment methods of bronchial foreign bodies. With this study, we hope to encourage clinicians to pay attention to bronchial foreign bodies and their complications.

Materials And Methods
Subjects and study design
This retrospective study included seven patients with a bronchial foreign body who underwent fiberoptic bronchoscope at the Third Affiliated Hospital of Zunyi Medical University, Zunyi, Guizhou, China between August 2015 and October 2019. The patients were diagnosed based on pathological biopsy results. This study excluded patients with contraindications for fiberoptic bronchoscopy treatment. All participants signed a written informed consent form before the fiberoptic bronchoscopy surgery. However, the Ethics Committee of the Third Affiliated Hospital of Zunyi Medical University waived the requirement for ethical approval for this study, given the retrospective design.

Fiberoptic bronchoscopic surgery and interventional therapy
Before surgery, the patients were assessed for blood pressure, and electrocardiogram and blood gas
analysis were performed. We also performed routine blood-, blood ion-, and coagulation function tests, and screened for hepatitis B virus and HIV. A fiberoptic bronchoscopic (OLYMPUS BF-1T150, Olympus Corporation, Japan) surgery was performed under local anesthesia. The procedure was done while monitoring blood pressure, pulse, breathing, and blood oxygen saturation. Oxygen was given during the operation. When the fiberoptic bronchoscope passed through the glottis, the tip of the mirror was slanted to the left and the stem to the right to avoid damaging the vocal cords. We made sure to keep the fiberoptic bronchoscope in a middle position in the trachea. This was done to keep the walls in all directions in the field of view to avoid missing or passing the foreign body. When a foreign body was found, its position in the bronchi and its relationship with the surrounding mucosa were identified to determine the direction towards which the forceps should be opened. The distance between the lens tip and the foreign body was kept at about 5 mm, and we made sure the width to which the jaw could be opened was the most suitable one. We continuously adjust the position of the bronchoscope so that the it and foreign body were in line. For the removal of a foreign body, it is possible to use snare surgery, clamp surgery, or argon freezing surgery. When hyperplasia granulation tissue and bronchial stenosis are found, it is possible to treat these with balloon dilation surgery, argon gas knife surgery, high-frequency electric knife surgery, cryotherapy, or stent implantation surgery. The foreign bodies were removed for pathological examination.

Data collection
The medical records of the patients were retrospectively reviewed, and the following data were recorded: sex, age, time since onset, finger pulse oxygen saturation, causes behind the aspiration of the foreign bodies, clinical manifestations (including coughing, expectoration, fever, chest tightness, loss of appetite, hemoptysis, shortness of breath, and weight loss), CT imaging scans information, pathological manifestations, pathological biopsy results, fiberoptic bronchoscopic surgical techniques, and interventional therapy approaches.

Results
Basic characteristics of patients
Table 1 presents the basic characteristics of the seven patients included in this study. Among these, three were males and four were females. Five of the patients were over 50 years old (71.4%). The
time since onset was irregular, ranging between six hours and 30 days, with five of the patients having the foreign body for 5-7 days. One of the patients had a finger pulse oxygen saturation below 90%. The causes behind the aspiration of the foreign bodies included laughing while eating, aspiration, being in a seizure state, and talking while eating in one patient each, and coughing while eating in three patients.

Clinical manifestations
Table 2 shows the clinical manifestations of the seven patients with a bronchial foreign body. Symptoms included coughing in all patients (100%), sputum in six (85.7%), shortness of breath in six (85.7%), chest tightness in four (57.1%), weight loss in two (28.6%), hemoptysis in one (28.6%), fever in one (14.3%), and loss of appetite in one (14.3%).

CT imaging findings
Table 3 and figure 1-6 show the results of CT imaging, performed in the seven patients with a bronchial foreign body. Among these patients, right lung disease was found in five patients, left lung disease was found in one, and CT scans were normal in one. The foreign body could be viewed in the CT images of only in one patient.

Pathological results
Table 4 and figure 7-13 show the pathological manifestations fiberoptic bronchoscopy performance and pathological biopsy results of the seven patients with a bronchial foreign body. Among these patients, four had a plant-derived foreign body – peanuts in three and a chili peel in one. In two cases the foreign body was a compound of calcium and phosphorus – a duck bone in one and a tooth in the other. In one case a pen cap was identified without the need for a biopsy.

Fiberoptic bronchoscopy results and interventional therapy methods
Table 5 shows the results of fiberoptic bronchoscopic surgical and interventional therapy methods, and follow-up in the seven patients with a bronchial foreign body. The foreign bodies were found and removed in all seven patients. Surgical procedures included clamp surgery, snare surgery, and argon freezing surgery. Tracheal stenosis occurred in three patient. Bronchial stenosis with granulation tissue formation was found in two patients. The granulation tissues and tracheal stenosis were resected by argon gas knife surgery in one and freezing surgery in the other. Follow-up of seven
patients, clinical symptoms improved in three patients, and four patients were completely cured.

Discussion

The results of this study indicate that older patients are more prone to tracheal foreign bodies. The patients differed in the manifestations and complications of the stationary tracheal or bronchial foreign bodies, time since onset, and the severity of the disease. There are clear causes for the occurrence of foreign bodies in the lower respiratory system. Lin et al. reported that asymptomatic bronchial foreign bodies were common in the elderly. Ramos et al. reported that asymptomatic bronchial foreign bodies are often misdiagnosed, delaying treatment by months to years. Complications and clinical manifestations also differed between patients with a static tracheal or bronchial foreign body included in our study. Coughing, sputum production, and shortness of breath were the most common clinical manifestations. Ramos et al. reported that the most common clinical manifestations of bronchial foreign bodies were coughing (66.1%), asphyxia (27%), dyspnea (26.6%), fever (22.2%), and hemoptysis (17.2%).

In this study, CT imaging results indicated that most of the foreign bodies in the bronchi were in the right lung. This might be related to the anatomy of the lower respiratory tract. The right bronchus is thick and steep, while the left one branches from the trachea at a sharper angle. Foreign bodies entering the trachea can more easily find their way to the right bronchus than to the left. When complications occur, CT imaging cannot always identify the foreign bodies that cause the disease. Ramos et al. reported that the right middle bronchus and lower lobe bronchi were the sites where foreign bodies often occur, and chest radiographs were normal in more than 20% of the patients. It was possible to see a foreign body in radiographs of only 26% of the patients. Clinically, because the possibility of bronchial foreign bodies is often neglected, anti-infective treatment is usually prescribed, with repeated antibiotic treatment. The efficacy, however, is poor and the patient's treatment opportunity is delayed.

Results of this study show that plant-derived foreign bodies are more common, with most of which being peanuts. This is presumably because peanuts can easily enter the trachea. One case in our
study was the aspiration of a tooth. This was in an elderly patient after cerebral infarction. In another case, the patient accidentally bit off the pen cap during a seizure. Ramos et al. reported that the most common bronchial foreign bodies in adults were seeds and fragments of bones.

In this study, the foreign bodies were removed in all seven patients. Our results show that when a stationary foreign body is not treated promptly, various complications might occur. Therefore, it is necessary to remove a foreign body as soon as possible and, if necessary, perform the bronchial interventional treatment to improve the patient’s symptoms.

This study has some limitations. First, the number of cases is small. The sample size needs to be larger for more powerful analysis. Second, this study was conducted in a single center. A multi-center study is needed to verify these results. Third, the reported data were obtained through a retrospective analysis. Fourth, with a larger number of cases, it would be possible to perform statistical analysis.

In conclusion, stationary bronchial foreign bodies can produce various complications, that should not be ignored. When foreign bodies are found, they must be removed as soon as possible, and bronchial interventional treatment should be enacted when necessary, to bring the hope of a cure to the patient.

Declarations

Acknowledgements

Not applicable.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report.

Competing interests

The authors declare that they have no competing interests.

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Author information

Contributions

Ling Gong, Yi Huang, Guichuan Huang provided the patient's clinical information and drafted the manuscript. Daishun Liu and Xiaoping Tang have revised the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1: Analysis of basic characteristics in seven patients with a bronchial foreign body

| Number | Sex   | Age (years) | Time since onset (days) | Finger pulse oxygen saturation (%) | Causes behind the aspiration of foreign bodies                  |
|--------|-------|-------------|-------------------------|------------------------------------|---------------------------------------------------------------|
| 1      | Female| 51          | 6                       | 98                                 | Laughing while eating                                         |
| 2      | Male  | 76          | 30                      | 93                                 | Severe coughing while eating                                  |
| 3      | Male  | 75          | 7                       | 88                                 | Has a history of cerebral infarctic aspiration                 |
| 4      | Male  | 77          | 7                       | 97                                 | Coughing while eating                                         |
| 5      | Female| 21          | 6                       | 95                                 | Speaking while eating                                         |
| 6      | Female| 18          | 1/4                     | 92                                 | Being in a seizure state                                      |
| 7      | Female| 64          | 5                       | 98                                 | Coughing while eating                                         |

Table 2: Analysis of clinical manifestations in seven patients with a bronchial foreign body

| Symptoms                          | n (%)  |
|-----------------------------------|--------|
| Coughing                          | 7/7(100) |
| Sputum                            | 6/7(85.7) |
| Shortness of breath               | 6/7(85.7) |
| Chest tightness                   | 4/7(57.1) |
| Weight loss                       | 2/7(28.6) |
| Hemoptysis                        | 2/7(28.6) |
| Fever                             | 1/7(14.3) |
| Loss of appetite                  | 1/7(14.3) |

Table 3: Analysis of CT imaging performed in seven patients with a bronchial foreign body
Table 4: Analysis of pathological manifestations and pathological biopsy results in seven patients with a bronchial foreign body

| Number | Pathological manifestations                      | Pathological biopsy results          |
|--------|--------------------------------------------------|--------------------------------------|
| 1      | Plant-derived foreign body                       | A piece of chili peel                |
| 2      | Minerals (mainly calcium and phosphorus) mixed   | A piece of duck bone                 |
| 3      | A compound of calcium and phosphorus             | A tooth                              |
| 4      | Large number of plant cells                      | A peanut                             |
| 5      | Large number of plant cells                      | Cracked peanuts                      |
| 6      | Identified without the need for a biopsy         | A pen cap                            |
| 7      | Large number of plant cells                      | A peanut                             |

Table 5: Analysis of fiberoptic bronchoscopic surgical and interventional therapy methods, and follow-up results in seven patients with a bronchial foreign body
| Number | Fiberoptic bronchoscopic surgical | Interventional therapy methods | Follow-up results |
|--------|----------------------------------|---------------------------------|------------------|
| 1      | Right middle lobe foreign body obstruction, granulation tissue formation and opening stenosis | Foreign body clamp surgery + argon gas knife surgery + freezing surgery | Improved clinical symptoms |
| 2      | Foreign body obstruction in the right main bronchus | Foreign body clamp surgery | Complete cure |
| 3      | Foreign body obstruction in the right middle and lower lobe openings | Foreign body clamp surgery | Complete cure |
| 4      | Right middle bronchial foreign body obstruction | Foreign body removal after argon freezing surgery | Complete cure |
| 5      | Left lower lobe foreign body completely obstruction and granulation tissue formation, left lower lobe opening stenosis | Foreign body clamp surgery + argon gas knife surgery + freezing surgery | Improved clinical symptoms |
| 6      | Foreign body obstruction in the right main bronchus | Foreign body snare surgery | Complete cure |
| 7      | Foreign body obstruction in the lower lobe of the right lung, right lower lobe opening stenosis | Foreign body clamp surgery + argon gas knife surgery + freezing surgery | Improved clinical symptoms |

Figures

**Figure 1**

Lobar pneumonia in the right middle lobe of NO.1 patient
Figure 2

Right lung lower lobe pneumonia of NO.3 patient
Figure 3

Right lung middle lobe syndromes of NO.4 patient
Figure 4

Left lower lobe bronchial occlusion with atelectasis of NO.5 patient
Figure 5

Foreign body retention in right main bronchus of NO.6 patient
Right lung pneumonia with right middle lobe atelectasis of NO.7 patient
Figure 7

A piece of chili peel of NO.1 patient
Figure 8

A piece of duck bone of NO.2 patient
Figure 9

A tooth of NO.3 patient
Figure 10

A peanut of NO.4 patient
Figure 11

Cracked peanuts of NO.5 patient
Figure 12

A pen cap of NO.6 patient
Figure 13

A peanut of NO.7 patient