



CLINICAL ANALYSIS OF 87 ADULT PATIENTS WITH FOREIGN BODIES IN THE AIRWAYS

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ABSTRACT

Objective: To retrospectively determine the clinical features of foreign bodies (FBs) in the airways of adults and the use of flexible bronchoscopy in diagnosis and therapy of FBs.

Material and Method: Eighty-seven patients with FBs in the airways were diagnosed in the Central Hospital of Wuhan between September 2002 and August 2014. We performed flexible bronchoscopic examinations under local anesthesia or intravenous general anesthesia for all patients to confirm the diagnosis, then removed the FBs using different apparatuses, such as foreign body forceps, baskets, and cryo-needles.

Results: The clinical symptoms of FBs in the airways included cough, fever, dyspnea, chest pain, and hemoptysis. We observed that organic bones were the most common FBs (59.77%), and the right inferior lobe bronchus was the most common site of impaction (59.77%). Most operations were performed under anesthesia, and the success rate of one-off removal was up to 90.80%. All patients recovered quickly after the procedure without complications.

Conclusion: Flexible bronchoscopy is an important diagnostic and therapeutic method for FBs in the airways of adults.

Keywords: Adults, tracheal bronchus, flexible bronchoscope, airway foreign body. *Nobel Med* 2016; 12(3): 51-56

SOLUNUM YOLLARINDA YABANCI CİSİM OLAN 87 YETİŞKİN HASTANIN KLİNİK ANALİZİ

ÖZET

Amaç: Retrospektif olarak yetişkinlerde solunum yollarındaki yabancı cisimlerin klinik özelliklerini ve fleksibl bronkoskopinin yabancı cisimlerin tanı ve tedavisinde kullanımını tesbit etmektir.

Materyal ve Metot: Eylül 2002 ile Ağustos 2014 tarihleri arasında Wuhan Merkez Hastanesi'ndeki 87 hastaya solunum yollarında yabancı cisim teşhisi konmuştur. Tüm hastalara teşhisi kesinleştirmek için lokal anestezi ya da intravenöz genel anestezi altında fleksibl bronkoskopi uyguladık, ardından yabancı cisimleri yabancı cisim forsepsi, basketler, krio iğneleri gibi farklı aparatlar kullanarak çıkardık.

Bulgular: Solunum yollarında yabancı cisimlerin öksürme, ateş, solunum güçlüğü, göğüs ağrısı ve hemoptizi gibi klinik semptomları vardır. Tıkanıklığın en çok görüldüğü yerin bronşların sağ alt lobu (%59,77) ve en çok görülen yabancı cismin ise organik kemikler (%59,77) olduğunu gözlemledik. Operasyonların çoğu lokal anestezi altında gerçekleştirilmiştir ve yabancı cismin bir kerede başarıyla çıkarılma oranı %90,80'dir. Tüm hastalar uygulama sonrası komplikasyon olmaksızın hızla iyileşmiştir.

Sonuç: Fleksibl bronkoskopi yetişkinlerin solunum yollarındaki yabancı cisimlerin tanı ve tedavisinde önemli bir metottur.

Anahtar kelimeler: Yetişkin, trakeal bronş, fleksibl bronkoskopi, solunum yollarında yabancı cisim. *Nobel Med* 2016; 12(3): 51-56

INTRODUCTION

Airway foreign body (FB) aspiration is a respiratory department emergency that occurs frequently in children more so than adults. Aspiration of FBs may result in cough, dyspnea, or even be life-threatening. Thus, it is of great importance to confirm the diagnosis and extract the FBs as soon as possible. Herein, we retrospectively collected 87 patients diagnosed with aspiration of FBs in the Central Hospital of Wuhan between September 2002 and August 2014, and analyzed the clinical characteristics and complications of these cases to determine the value of flexible bronchoscopy in diagnosing and removing airway FBs.

MATERIAL AND METHOD

This study was approved by the ethics committee of The Central hospital of Wuhan, and all the participants were given written informed consent before the study.

General Information

We retrospectively analyzed the inpatients and outpatients >14 years of age who underwent flexible bronchoscopic examinations in the Respiratory Department with the Central Hospital of Wuhan between September 2002 and August 2014. Of all these patients, 87 were diagnosed with airway FBs; 69 patients were males and 18 were females. The ages ranged from 24-82 years (mean age, 67.37±5.58 years), and 64 patients (73.56%) were > 65 years of age. The shortest time between aspiration and FB removal was 6 hours, while the longest time between aspiration and

FB removal was 7 years; the mean time was 3.48±2.14 months.

Clinical Diagnosis Of Airway FB Aspiration

All patients underwent chest computerized tomography (CT) scanning before flexible bronchoscopic examination. Considering the medical history, and the clinical and radiographic characteristics, preliminary diagnoses were made as follows: airway FB aspiration (n=75 [86.20%]), obstructive pneumonia (n=7 [8.04%]), and pulmonary tumors (n=5 [5.76%]).

Preparation

Informed consent form was obtained from all subjects before flexible bronchoscopic examinations. Other tests, such as routine hematology, coagulation profiles, electrocardiograms, pulmonary CT scans with 3D reconstruction, and arterial blood gas analysis, were also performed. Flexible bronchoscopes (BF-1T240 and BF-260; Olympus, Inc., Japan), various kinds of FB forceps, baskets, a cryotherapy unit (CA; Erbokryo Inc., Germany), high frequency electrotome/argon plasma coagulation unit (VIO-200D; Erbokryo Inc., Germany), a ventilator, multiple types of trachea cannulas, and laryngeal masks were prepared. Drugs with anti-infective, anti-tussive, and expectorant activities were used as needed.

Anesthesia

The majority of the 87 patients accepted localized anesthesia by inhaling 10 ml of 2% lidocaine (15-

20 min), and an additional 3-5 ml of lidocaine was sprayed as needed when the bronchoscope passed through the glottis. Patients that could not tolerate localized anesthesia or were at high risk underwent general intravenous anesthesia.

Operation

Pre-operative fasting and water deprivation for 6-8 hours were needed.

Localized anesthesia was conducted and all levels of the bronchus were carefully examined after the flexible bronchoscope passed through the nasal cavity and the glottis. Airway FBs were found and extracted by different tools, such as FB forceps, baskets, and cryo-needles.

A laryngeal mask (4#, diameter 10.2 mm) was inserted orally under intravenous anesthesia, and then connected to a ventilation and the vital signs of patients were monitored. The following procedure was the same as that under localized anesthesia after the flexible bronchoscope passed through the laryngeal mask. If the FBs were surrounded by granulation tissue, we first used a high-frequency electrotome to clean granulation tissue and remove FBs by other tools. Additionally, we used cryo-needles to eliminate the remaining granulation tissue after FB extraction, and performed bronchoalveolar lavage with 35-37°C normal saline for patients with obstructive pneumonia.

RESULTS

Clinical Presentation

Of all the patients, cough, fever, dyspnea, chest pain, and hemoptysis were the chief manifestations. A history of FB aspiration was confirmed in 75 cases (86.2%), while the other 12 cases (13.80%) had no history of FB aspiration. With the additional information provided by the CT scan (Figure 1), a preliminary diagnosis was made as follows: airway FB aspiration (n=75 [86.20%]), obstructive pneumonia (n=7 [8.04%]), and pulmonary tumors (n=5 [5.76%]; Table 1).

Endoscopic Characteristics

The bronchi of all 87 patients were either partly or completely blocked by FBs, and the local mucosa exhibited swelling and congestion. Forty-five patients (51.72%) had granulation tissue hyperplasia; 76 cases (87.35%) showed deep bronchi mucosal swelling and purulent secretion when we performed bronchoalveolar lavage. Distal bronchial stenosis and distortion were observed in 5 patients (5.74%).

Table 1. The preliminary diagnosis of CT scan

Diagnosis	n	%
Airway FB aspiration	75	86.20%
Obstructive pneumonia	7	8.04%
Pulmonary tumor	5	5.76%

n: The number of diagnosis of CT scan

Table 2. Features of the FBs

Group	n	%
Bone fragments	52	59.77%
Nutshell and beans	15	17.24%
Metal FBs	12	13.79%
Soft foreign bodies	5	5.74%
Remaining FBs	3	3.46%

n: The number of FBs

Table 3. Localization of FBs

Localization	n	%
Right inferior lobe bronchus	52	59.77%
Left inferior lobe bronchus	16	18.39%
Left or right main bronchus	8	9.19%
Right superior lobe bronchus	4	4.60%
Right middle lobe bronchus	3	3.45%
Left superior lobe bronchus	2	2.30%
Trachea	2	2.30%

n: The number of FBs

Features of The FBs

Fifty-two patients (59.77%) had bone fragments, including fishbones, chicken bones, duck bones, and teeth (Figure 2). The FBs of 15 cases (17.24%) were nutshell and beans, such as melon seed shells, soybeans, and broad beans. Metal FBs, including metal teeth braces, artificial teeth, coins, and lighter metal covers, were found in 12 patients (13.79%). Five patients (5.74%) had soft foreign bodies, such as bean curds and jelly, and the remaining 3 patients (4.60%) had other FBs, such as sticks and pen-caps (Table 2).

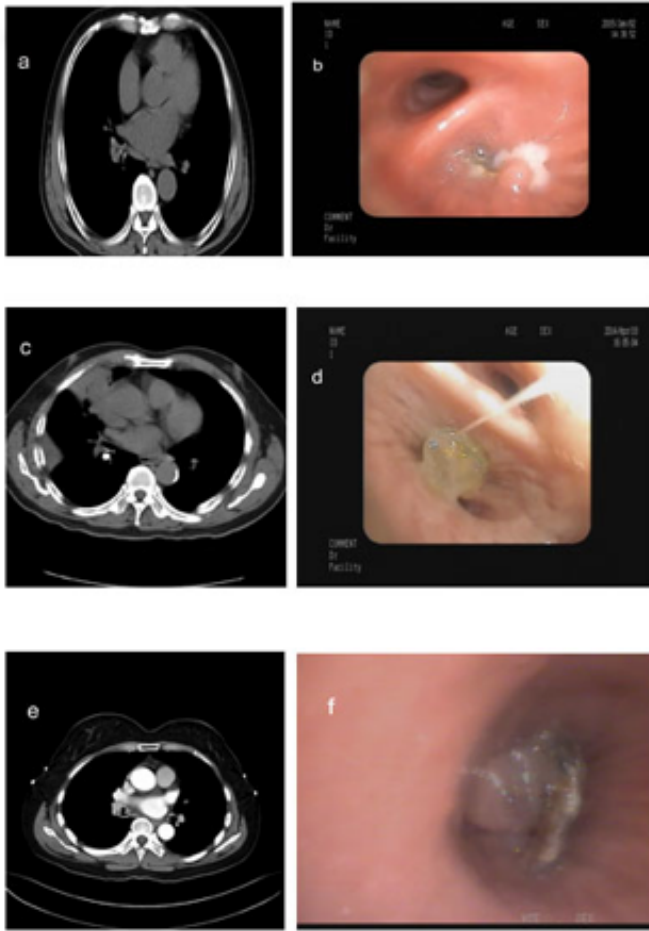


Figure 1.
a: CT performance of patient A **b:** Endoscopic performance of patient A **c:** CT performance of patient B
d: Endoscopic performance of patient B **e:** CT performance of patient C **f:** Endoscopic performance of patient C

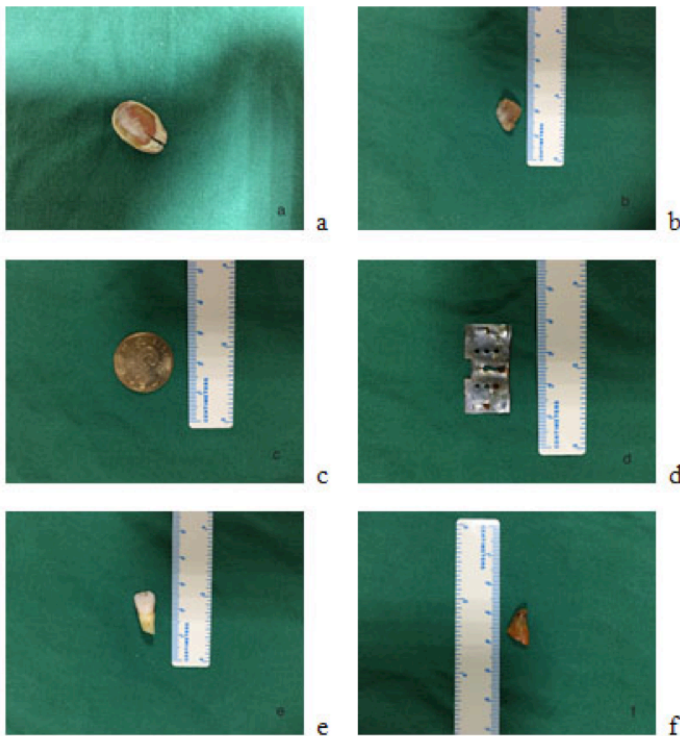


Figure 2.
a: Seed shells; **b:**sawdust; **c:** coins; **d:** metal pieces; **e:** teeth; **f:** pepper top

Localization of FBs

The FBs were located in the right inferior lobe bronchus in 52 patients (59.77%). In 16 patients (18.39%), FBs were lodged in the left inferior lobe bronchus, the left or right main bronchus in 8 patients (9.19%), the right superior lobe bronchus in 4 patients (4.60%), the right middle lobe bronchus in 3 bronchus (3.45%), in the left superior lobe bronchus in 2 patients (2.30%), and the trachea in 2 patients (2.30%)(Table 3).

Operation of an Electronic Bronchoscope

Most patients (74 patients [85.10%]) accepted localized anesthesia, and the remaining patients (13 patients [14.94%]) could not tolerate localized anesthesia or were at high risk for general intravenous anesthesia by laryngeal mask. The mean operative attempts for the bronchoscope to clamp FBs was 1.7 ± 0.5 ; the maximum number of attempts was 4 and the one-off removal rate was up to 90.80% (n = 79). During the operation, different tools were applied considering the features as well as the locations of the FBs. We removed FBs using basket in 36 patients, FB forceps in 21 patients, and cryo-needles in 17 patients. Moreover, FBs in 13 patients were removed using a combined application of a basket and cryo-needle. For 11 patients, FBs were surrounded by granulation tissue, and a high-frequency electrotome was used to clean granulation tissue before extracting FBs. In addition, 24 patients with significant granulation tissue proliferation accepted cryotherapy (120 sec/attempt, 3-4 attempts/spot) after FB extraction.

Complications and Follow-Up

None of the 87 patients had complications, such as fever, hemoptysis, and throat discomfort, after electronic bronchoscopic operations. In the 1-3 month follow-up, either by telephone call or clinic visit, all patients exhibited clear improvement in chest radiographic and endoscopic characteristics, such as atelectasis, obstructive pneumonia, mucosal swelling, and bronchial stenosis.

DISCUSSION

FB aspiration in the trachea or bronchi is an emergency in the respiratory department; approximately 75% events occur in children <3 years of age, while FB aspiration is infrequent in adults, of which the elderly are dominant.¹⁻³ Our data showed that 73.56% of the selected patients were elderly, which is in agreement with the published data. The potential mechanism of FB aspiration can be summarized as follows: the elderly are more likely to inhale FBs owing to flaccidity of throat muscles, gomphiasis, swallowing dysfunction, and disorders of the preservation reflex; incomplete closure of the glottis during laughing and eating is also

a cause of FB aspiration; and people that suck small objects in the mouth probably inhale the objects when they are frightened or take a deep breath.¹⁻³

The FBs can partly or completely block the airway, and can also cause local irritation and secondary infections.⁴ The clinical symptoms of FB aspiration include fever, wheezing, and coughing. Previous studies have indicated that coughing is the main presentation for FB aspiration, accounting for 59%-82.5% of all cases.^{2,5} Prolonged FB obstruction will result in local inflammation and proliferation of granulation tissue, and this would consequently cause persistent cough, respiratory secretions, hemoptysis, and wheezing, or even atelectasis and obstructive pneumonia.^{6,7} In the current study, we observed granulation tissue hyperplasia in nearly one-half of the 87 patients (45 patients [51.72%]), and distal bronchial stenosis and distortion in a few patients (5 patients [5.74%]).

CT scanning plays an essential role in diagnosing FB aspiration, which clearly indicates the size, shape, location of FBs, and can even reveal the distance to the carina and trachea wall.^{8,9} After CT scanning, most of the FBs (86.20%) were diagnosed in time, but occasionally the FBs were not localized (12 patients [13.80%]); a possible reason for this would be that some FBs were metalloid, tiny, or surrounded by granulation tissue and could not be identified on CT images.

Considering the history of FB aspiration, clinical symptoms, and chest radiographic characteristics, the majority of patients were diagnosed in a timely fashion. Diagnosis in the elderly is more likely to be delayed.¹⁰ For example, one patient in our study was diagnosed 7 years after FB aspiration, and one published study reported a patient who went 18 years before the FB was extracted.¹¹ The possible reasons for delayed diagnosis and extraction are as follows:

1. Because protective reflexes of tracheal and bronchial mucosa are weak in elderly people, the symptoms after FB aspiration, such as coughing and wheezing, are not apparent and it is difficult to confirm the aspiration history.
2. Some FBs do not show typical radiographic characteristics on CT images.
3. Elderly patients with atypical clinical characters, such as coughing, can be easily misdiagnosed to have bronchitis or pneumonia when lacking a definite history of aspiration.

Airway FB can be categorized as follows: bone; food; metal; artificial teeth; and plastic materials.¹² In our study, 52 FBs (59.80%) were bones, including fishbones, chicken bones, and duck bones. The aspiration of other types FBs is also connected with feeding. The location of

FBs mainly depends on the position of patient, the size and shape of FBs. Meanwhile, owing to the anatomical structure of bronchi, inferior lobe bronchus, especially right inferior lobe bronchus, is the most common position of FBs.^{7,12,13}

Killian performed bronchoscopic examinations on 1897 patients for FB extraction.¹⁴ Currently, we can diagnose airway FB aspiration directly with a bronchoscopic examination, and most FBs can be removed by rigid or flexible bronchoscopy, and a few FBs surrounded by granulation tissue or tightly adhered to surrounding tissue could be removed with the help of a high frequency electrotome and argon plasma coagulation.^{4,15,16} In the current study, all FBs were successfully removed by flexible bronchoscopy, and the one-time successful rate was as high as 90.80% (79 patients), and some FBs that were surrounded by granulation tissue were removed after clearing the granulation tissue.

The instruments applied to remove FBs during flexible bronchoscopic examination mainly include basket, FB forceps, cryo-needles and negative pressure suction. Sometimes, a combined application of the aforementioned tools is necessary. In the current study, baskets were the most common solution to remove FBs, 36 of 87 cases [41.4%]; FB forceps and freezing probes were also applied. Based on our experience, large, thick, smooth (broad bean, spherical objects) FBs are best removed by baskets. For slender, rough (coins and fishbones) FBs, forceps are suggested. For soft, rotten (bean curds and jelly) FBs, freezing and adherence to the main bronchus should be attempted before using a basket or clamps. For FBs surrounded by granulation tissue, we need to clean the granulation tissue before extracting FBs to avoid bleeding and airway mucosal damage.

The prognosis of FB aspiration is good. In the current study, the clinical symptoms of all patients improved after FB removal. Chest radiographic and endoscopic characteristics, such as atelectasis, obstructive pneumonia, mucosal swelling, and bronchial stenosis, were significantly improved.

The incidence of FB aspiration in adults is much less than children. The common manifestations of FB aspiration include coughing, wheezing, and fever without distinctive symptoms, and the diagnosis and therapy could be easily delayed in the elderly. We should confirm the diagnosis by analyzing clinical history, age, and chest tomography. Flexible bronchoscopy plays an essential role in diagnosing FB blocking and removing FBs with forceps, baskets, and cryo-needles.

*The authors declare that there are no conflicts of interest.



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