Chris Kyriakopoulos[1], Athena Gogali[1], Konstantinos Tatsis[1], Nektarios Anagnostopoulos[2], Grigoris Stratakos[2], Konstantinos Kostikas[1]

ckyriako123@gmail.com

Case report

A 68-year-old man with haemoptysis and extensive ipsilateral lung infiltrates

A 68-year-old male presented to the emergency department with a 24-h history of haemoptysis and fever. The patient also reported a productive cough for 5 years. He was a current smoker (smoking history of 80 pack-years) with an otherwise unremarkable past medical history. On examination, his respiratory rate was 24 breaths per min, heart rate was 120 beats per min, temperature 39.2ºC and his oxyhaemoglobin saturation was 98% in room air. On auscultation, breath sounds were reduced and end-expiratory crackles were heard over the left lung. Physical examination was otherwise normal. Blood tests showed: white blood cells 14500 cells·μL^{-1} (neutrophils 12000 cells·μL^{-1}, lymphocytes 1900 cells·μL^{-1}), haemoglobin 13.9 g·dL^{-1}, platelets 256000 μL^{-1}, C-reactive protein (CRP) 128 mg·L^{-1}, erythrocyte sedimentation rate 90 mm·h^{-1}, normal electrolytes, urea 45 mg·dL^{-1} and creatinine 1.22 mg·dL^{-1}.

A chest radiograph showed extensive infiltrates in the left lung field and reduced left lung size (figure 1).

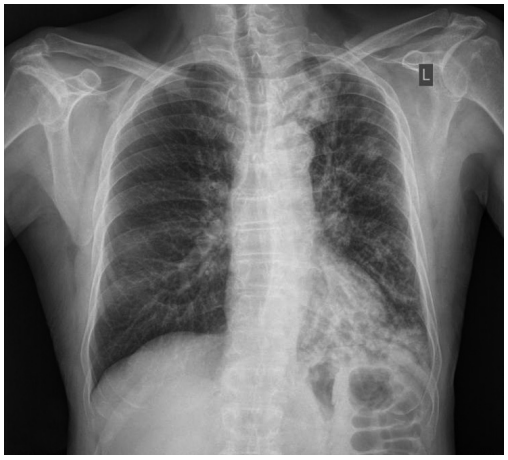

Figure 1 *Chest radiograph (AP view in inspiration) showing reduced left lung size and infiltrates in the left lung field.*

Task 1
Which of the following investigations would you order now? Choose as many as apply.

a) Blood and sputum cultures
b) Chest computed tomography (CT)
c) Spirometry
d) Bronchoscopy

Cite as: Kyriakopoulos C, Gogali A, Tatsis K, *et al*. A 68-year-old man with haemoptysis and extensive ipsilateral lung infiltrates. *Breathe* 2021; 17: 200229.

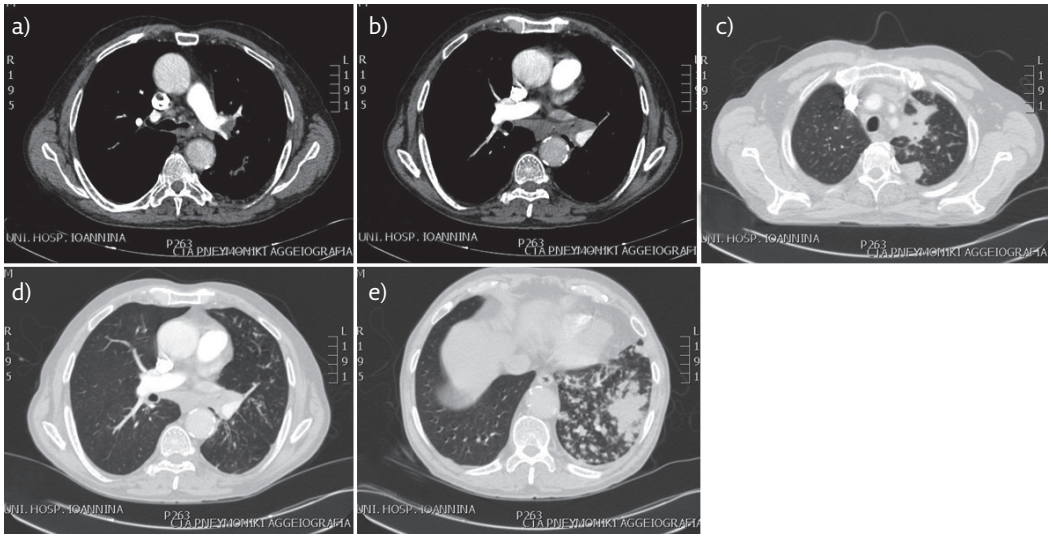

Figure 2 *Chest CT. a, b) Obstruction of left main lobe, slightly enlarged mediastinal and left hilar lymph nodes, c–e) lung infiltrates and tree-in-bud opacities in both left upper and lower lobes.*

Answer 1
a and b

A chest CT (fig. 2) was ordered.

Chest CT showed obstruction of the left main bronchus, mass-like opacity of the left lower lobe, infiltrates in the left lung and enlarged mediastinal and left hilar lymph nodes (figure 2a–e). Blood cultures, sputum culture, stool culture and urine culture were performed. Sputum culture for common pathogens, tuberculous and nontuberculous mycobacteria was negative.

Task 2
What are the possible differential diagnoses? Choose as many as apply.

a) Tuberculosis
b) Cancer
c) Post-obstructive bacterial pneumonia
d) Foreign body inhalation

Answer 2
a, b, c and d.

Taking into consideration these findings, we suspected that the partial obstruction of the left lung may be due to lung cancer, foreign body aspiration, or less probably, to tuberculosis; leading to superimposed bacterial pneumonia (reflected by fever, neutrophilia, elevated CRP and consolidation). The patient was started on antibiotics (piperacillin–tazobactam for better coverage of Gram-negative and anaerobic bacteria) followed by partial improvement of his clinical condition, reduction of the symptoms and reduction of the inflammatory markers. The patient was afebrile after the third day of hospitalisation.

Task 3
What would be the next step(s) in the management of this patient?

a) Continue antibiotics
b) Flexible bronchoscopy
c) Rigid bronchoscopy

Answer 3
a and b

Flexible bronchoscopy revealed multinodular vegetation with an irregular surface at the entrance of the left main bronchus, causing stenosis of more than 90%, not allowing access to the peripheral bronchi and a large amount of purulent secretions (figure 3). Culture of bronchial secretions revealed *Klebsiella pneumoniae* $<10^4$ cfu·mL^{-1}. The cytological examination demonstrated evidence of inflammation and necrosis, while pathological examination of endobronchial biopsies reported: "Tissue specimens of respiratory pseudostratified columnar epithelium with squamous metaplasia and lymphocytic infiltration. No atypia is observed".

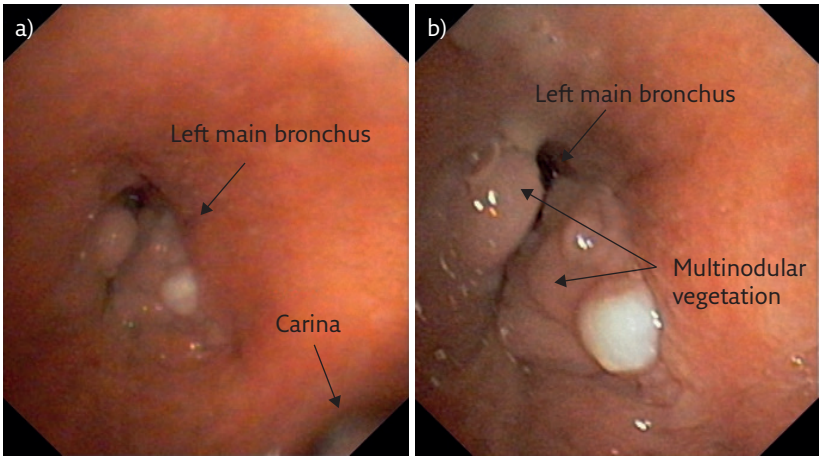

Figure 3 *Bronchoscopy showing multinodular vegetation with irregular surface at the entrance of the left main bronchus, causing stenosis of >90%.*

Task 4
Before bronchoscopy, upper left lobe bacterial pneumonia was the working diagnosis. What is the most possible differential diagnosis after the bronchoscopy (figure 3)?

Answer 4
Based on the bronchoscopic image the most possible diagnosis is a malignant tumour of the left main bronchus with post-obstructive pneumonia.

The patient continued receiving antibiotics with significant improvement of his clinical condition, resolution of the symptoms and partial improvement of the chest radiograph with a decrease of the infiltrates and total left lung expansion (figure 4). Lymphocytic infiltration on endobronchial biopsy and lack of malignant cells would suggest that systemic corticosteroids would be beneficial for reducing local inflammation, providing that tuberculosis is excluded. In our case, negative culture results for tuberculosis were obtained after the patient's improvement, so systemic corticosteroids were not administered.

Figure 4 *Repeat chest radiograph showing a decrease of the infiltrates and total left lung expansion.*

Task 5
What would be the next appropriate step in the management of this patient?

Answer 5
Repeat flexible bronchoscopy.

Because of the remarkable improvement and the negative for malignancy cytological examination and endobronchial biopsies, we decided to perform a second bronchoscopy. Repeat flexible bronchoscopy demonstrated significant reduction of the inflammatory tissue at the entrance of the left main bronchus and the presence of a foreign body in the distal end of it with granulation tissue around it (figure 5a–b).

Task 6
What would be the next step in the management of this patient?

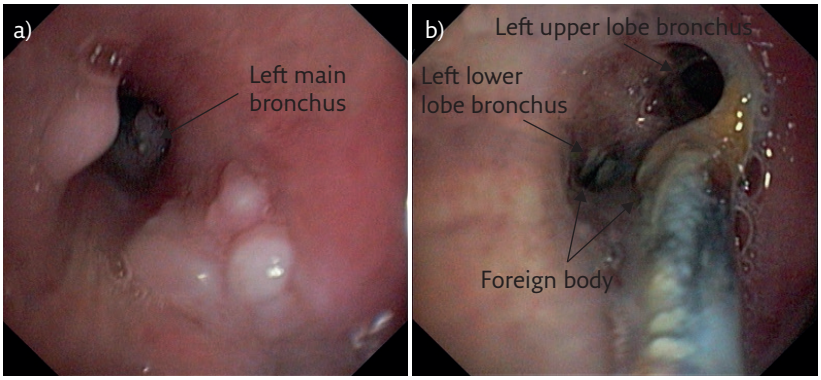

Figure 5 *Repeat bronchoscopy. a) Reduced size of inflammatory tissue in left main bronchus, b) foreign body in the distal end of left main bronchus with granulation tissue around it.*

Answer 6
Rigid bronchoscopy is the procedure of choice for retrieval of airway foreign bodies.

When rigid and flexible bronchoscopy are combined the maximum safety and efficacy can be attained [1]. In this case, rigid bronchoscopy was performed under general anaesthesia combined with flexible bronchoscopy, through the shaft of the rigid tracheoscope. After coagulating with electrocautery and removing the granulation tissue which obstructed the left main bronchus, a foreign body (chicken bone) of 3 cm length was found and removed using rigid grasping forceps and the rat-tooth flexible forceps with which we steadily grasp tiny solid objects (figure 6). After the bone was pulled within the shaft of the tracheoscope, this was removed en bloc from the trachea. Given the size of the bone, it would be impossible to remove it through the vocal cords otherwise. After removal of the foreign body, the patient's condition further improved and he was dismissed 48 h after the procedure.

The patient underwent another chest CT scan, 1 month later, that demonstrated cystic bronchiectasis, fibrotic changes and regions of scarring on the left lower lobe (figure 7).

Figure 6 *Foreign body (chicken bone) after removal through rigid bronchoscopy.*

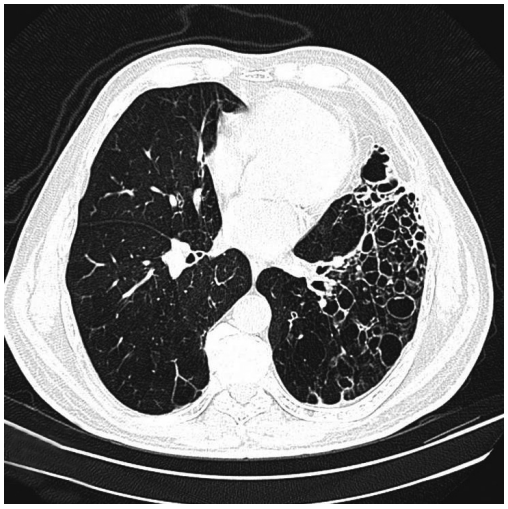

Figure 7 *Follow-up chest CT scan (1 month later) showing cystic bronchiectasis, fibrotic changes and regions of scarring on the left lower lobe.*

Discussion

In 1897 Gustav Killian reported the first foreign body removal from the lower respiratory tract using an oesophagoscope, and, during the first quarter of the 20th century, he developed rigid bronchoscopy. Chevalier Jackson further developed the technique in the USA [2]. Flexible bronchoscopy through an oropharyngeal approach is currently the procedure of choice in patients without symptoms or signs of acute asphyxiation and especially in those with foreign bodies which have wedged in distal bronchi. Rigid bronchoscopy is preferable in cases of large foreign bodies in the central airways and for complex foreign bodies that cannot be removed by flexible bronchoscopy [3]. Often, a combination of flexible and rigid bronchoscopy is needed. Techniques such as cryotherapy, electrocautery, and laser or argon plasma coagulation are helpful, especially for organic foreign bodies or in cases of granulation tissue formation. Rarely, surgical retrieval of the foreign body cannot be avoided [4].

Task 7
Why does foreign body aspiration (FBA) most often happen in children and elderly patients?

Task 8
Where do foreign bodies most often lodge?

Answer 7
FBA is a rarely occurs in young adults [5] but is very frequent in paediatric practice (80% of the cases) and quite common in the elderly population [6]; however, non-asphyxiating FBA is sometimes a delayed diagnosis, partly because it does not have a specific clinical manifestation unless the patient recalls an antecedent aspiration event [7]. Among paediatric patients, it is more common between the ages of 12 and 48 months owing to their tendency to put things into the mouth, poor chewing ability, lack of posterior dentition, and an impulse to have vigorous, uninhibited inspirations when coughing, laughing or feeling frightened [8]. The increased risk in elderly patient results from multiple factors including poor dentition, altered sensorium, poor coordination of deglutition mechanisms, and significant comorbidities such as degenerative neurological diseases (*e.g.* Alzheimer's or Parkinson's disease) [9].

Answer 8
In the right bronchial tree.

In adults, foreign bodies tend to lodge in the right bronchial tree as the right main stem bronchus has a smaller angle to the trachea and a larger diameter than the left main stem bronchus. However, as in this case report, foreign bodies may enter the left main stem bronchus and have been reported in all airway locations. A recent retrospective study revealed that foreign bodies can settle in the trachea (2.7%), right main bronchus (4.5%), right upper lobe bronchus (2.7%), bronchus intermedius (23.4%), right middle lobe bronchus (3.6%), right lower lobe bronchus (27%), left main bronchus (18%), left upper lobe bronchus (3.6%) and left lower lobe bronchus (14.4%) [10]. The objects that are most frequently aspirated are: food, which is present in 75% of the cases; other organic materials, such as bones, teeth and plants, 7%; and non-organic materials such as metals, dentures, pills and plastics [11].

Task 9
What are the main symptoms of FBA and which diseases are often misdiagnosed in FBA cases?

Answer 9

FBA can result in symptoms of varying severity, or it can be completely asymptomatic. The cardinal symptom in non-asphyxiating FBA in adults is cough (81% of cases); however, haemoptysis, wheezing, chest pain and dyspnoea may also occur. Symptoms frequently mimic wheezing conditions such as asthma or COPD [12].

Foreign bodies typically lodge distally in the lower lobe bronchi or the bronchus intermedius so acute presentation is rare; nevertheless, life-threatening asphyxia and sudden decompensation secondary to complete obstruction may occur [13]. Our patient presented with cough and haemoptysis.

Physical examination may reveal stridor, unilateral wheezing, or even diminished breath sounds may be encountered, or may be normal, depending on the degree and location of the obstruction [14].

Severe complications of FBA are more common in cases in which the foreign body is located in the tracheobronchial tree for a prolonged time [15]. Often, foreign bodies are incidentally revealed on radiographic imaging ordered for symptoms mistakenly attributed to other medical conditions, including unresolving recurrent pneumonia, asthma and COPD, or during flexible bronchoscopy for investigation of symptoms of endobronchial disease [16]. The retained foreign body may result in unresolving pneumonia, lung abscess, bronchial stenosis, bronchiectasis, pneumothorax or empyema if the diagnosis of FBA is delayed [17, 18].

Formation of granulation tissue around the foreign body may occur when the foreign body remains for a long time, as in this case, and may resemble an endobronchial tumour [19]. Up to 80% of foreign bodies are not visible on chest radiographs. The sensitivity of multidetector CT for the detection of a bronchial foreign body is close to 100% with a specificity of between 66.7% and 100%. CT findings usually include FBA complications such as unilateral lung hyperlucency, lobar consolidation, pleural effusion, bronchiectasis or atelectasis [20]. False positives are generally related to the presence of a mucus plug or artefact [21].

After aspiration, post-obstructive pneumonia may occur, which leads to subsequent development of bronchiectasis, usually localised [22]. Obstructive emphysema, atelectasis and infection due to a retained tracheobronchial foreign body precede the development of chronic inflammation and bronchiectasis [23]. The pathophysiological mechanisms include infection and impaired secretion clearance or impaired host defence mechanisms. The host immune response involves the release of inflammatory mediators leading to chronic airways inflammation with subsequent ulceration and airway dilation leading to the formation of bronchiectasis [24].

Bronchiectasis is one of the most important complications of a long retained foreign body and may require surgical resection in cases with recurrent infections. However, there are reports in the literature, mostly referring to children, suggesting the resolution of bronchiectasis and/or bronchial dilatation secondary to FBA after extracting a long-standing retained foreign body [25].

Affiliations

Chris Kyriakopoulos[1], Athena Gogali[1], Konstantinos Tatsis[1], Nektarios Anagnostopoulos[2], Grigoris Stratakos[2], Konstantinos Kostikas[1]

[1]Respiratory Medicine Dept, University of Ioannina, Ioannina, Greece. [2]Respiratory Medicine and Interventional Pulmonology Unit, 1st Respiratory Medicine Dept, University of Athens, Athens, Greece.

Conflict of interest

None declared.

References

1. Rosell A, Stratakos G. Therapeutic bronchoscopy for central airway diseases. *Eur Respir Rev* 2020; 29: 190178.
2. Zaytoun GM, Rouadi PW, Baki DH. Endoscopic management of foreign bodies in the tracheobronchial tree: predictive factors for complications. *Otolaryngol Head Neck Surg* 2000; 123: 311–316.
3. Batra H, Yarmus L. Indications and complications of rigid bronchoscopy. *Expert Rev Respir Med* 2018; 12: 509–520.
4. Duan L, Chen X, Wang H, *et al*. Surgical treatment of late-diagnosed bronchial foreign body aspiration: a report of 23 cases. *Clin Respir J* 2014; 8: 269–273.
5. Teramoto S, Matsuse T, Ouchi Y. Foreign body aspiration into the lower airways may not be unusual in older adults. *Chest* 1998; 113: 1733–1734.
6. Teramoto S, Yamamoto H, Yamaguchi Y, *et al*. A novel diagnostic test for the risk of aspiration pneumonia in the elderly. *Chest* 2004; 125: 801–802.
7. Baharloo F, Veyckemans F, Francis C, *et al*. Tracheobronchial foreign bodies: presentation and management in children and adults. *Chest* 1999; 115: 1357–1362.
8. Maguire A, Gopalakaje S, Eastham K. All that wheezes is not asthma: a 6-year-old with foreign body aspiration and no suggestive history. *BMJ Case Rep* 2012; 2012: 006640.
9. Yapici D, Atici S, Birbicer H, *et al*. Manufacturing defect in an endotracheal tube connector: risk of foreign body aspiration. *J Anesth* 2008; 22: 333–334.

10. Ng J, Kim S, Chang B, *et al.* Clinical features and treatment outcomes of airway foreign body aspiration in adults. *J Thorac Dis* 2019; 11: 1056–1064.
11. Sehgal IS, Dhooria S, Ram B, *et al.* Foreign body inhalation in the adult population: experience of 25,998 bronchoscopies and systematic review of the literature. *Respir Care* 2015; 60: 1438–1448.
12. Keshishyan S, Mohan A, Ahmed S, *et al.* Airway obstruction caused by iron pill aspiration: an interventional pulmonology approach to prevent surgery. *Heart Lung Circ* 2018; 27: e89–e92.
13. Simonassi CF, Majori M, Covesnon MG, *et al.* Competence in pulmonary endoscopy emergencies. *Panminerva Med* 2019; 61: 386–400.
14. Boyd M, Chatterjee A, Chiles C, *et al.* Tracheobronchial foreign body aspiration in adults. *South Med J* 2009; 102: 171–174.
15. Metrangelo S, Monetti C, Meneghini L, *et al.* Eight years' experience with foreign-body aspiration in children: what is really important for a timely diagnosis*? J Pediatr Surg* 1999; 34: 1229–1231.
16. Kupeli E, Khemasuwan D, Tunsupon P, *et al.* "Pills" and the air passages: a continuum. *Chest* 2015; 147: 242–250.
17. Lima M, Ugolini S, Di Salvo N, *et al.* A unique case of foreign body aspiration and recurrent pneumothorax. *Pediatr Med Chir* 2017; 39: 171.
18. Rehman SU, Sharif N, Zubairi AB. Bilateral airway foreign body aspiration as a cause of recurrent pneumonia. *BMJ Case Rep* 2010; 2010: 3002.
19. Aissaoui A, Salem NH, Chadly A. Unusual foreign body aspiration as a cause of asphyxia in adults: an autopsy case report. *Am J Forensic Med Pathol* 2012; 33: 284–285.
20. Kim TJ, Goo JM, Moon MH, *et al.* Foreign bodies in the chest: how come they are seen in adults? *Korean J Radiol* 2001; 2: 87–96.
21. Zissin R, Shapiro-Feinberg M, Rozenman J, *et al.* CT findings of the chest in adults with aspirated foreign bodies. *Eur Radiol* 2001; 11: 606–611.
22. Cantin L, Bankier AA, Eisenberg RL. Bronchiectasis. *Am J Roentgenol* 2009; 193: 158–171.
23. Haas AR, Vachani A, Sterman DH. Advances in diagnostic bronchoscopy. *Am J Respir Crit Care Med* 2010; 182: 589–597.
24. King PT. The pathophysiology of bronchiectasis. *Int J Chron Obstruct Pulmon Dis* 2009; 4: 411–419.
25. Mansour Y, Beck R, Danino J, *et al.* Resolution of severe bronchiectasis after removal of long-standing retained foreign body. *Pediatr Pulmonol* 1998; 25: 130–132.