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Case Report

A rare case of foreign body inhalation masquerading as calcification in the right upper lobe suggestive of tuberculosis

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ABSTRACT

Airway foreign bodies are a common clinical emergency, predominantly occurring in children, with adults less frequently affected. Airway foreign bodies can cause a variety of symptoms, with adults more commonly presenting with cough, a factor that often leads to misdiagnosis or missed diagnosis. Due to anatomical features, most foreign bodies are more likely to be aspirated into the right bronchus, especially the right lower and middle bronchi, with the right upper lung less commonly involved. Here, we report a case where a small, sharp foreign body (a chicken bone) became lodged at the opening of the right upper lobe bronchus in a healthy middle-aged male. Initially, the foreign body was mistaken for an old tuberculous calcification due to recurrent coughing and shortness of breath over two years, misdiagnosed as chronic obstructive pulmonary disease. Eventually, the foreign body was successfully removed. Therefore, the possibility of foreign body inhalation should not be overlooked in adult patients presenting with recurrent cough symptoms.

1. Introduction

Foreign body aspiration (FBA) is a life-threatening conditions common in both adults and children. Foreign body inhalation frequently occurs in children under the age of three, while in adults, such incidents are relatively rare, accounting for only 20 % of reported cases [1]. The clinical manifestations of foreign body aspiration differ between children and adults. Due to the relatively narrower diameter of the tracheobronchial tree in children, foreign bodies typically lodge in the proximal airways, leading to wheezing and acute respiratory distress. In contrast, adults have a larger tracheobronchial diameter, resulting in fewer incidents of choking and severe respiratory difficulty. Symptoms in adults are usually caused by obstruction of the distal airways by the foreign body. Non-choking foreign bodies most commonly present with coughing (66.1 %), choking (27 %), breathing difficulties (26.6 %), fever (22.2 %), and haemoptysis (17.2 %) [2]. Some patients with mild cases may remain asymptomatic for months to years, leading to delayed diagnosis. Long-standing cases with radiographic findings of lobe or segmental atelectasis, pulmonary consolidation, or recurrent inflammation at the same site are often misdiagnosed as lung cancer, tuberculosis, obstructive pneumonia, or chronic obstructive pulmonary disease. Dry rales heard upon auscultation in cases of foreign body (FB) obstruction can be mistakenly diagnosed as

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bronchial asthma or the inflammatory changes localised to a pneumonia diagnosis without further investigation of the underlying cause. As illustrated in this case, despite undergoing a chest CT scan and hospital visits, a persistent cough was misdiagnosed as chronic obstructive pulmonary disease. Calcifications in the right upper lobe were mistakenly attributed to old tuberculosis, and only upon bronchoscopy was the bronchial foreign body discovered.

2. Case presentation

The patient is a 53-year-old male with a 20-year history of smoking, averaging 3–4 cigarettes per day. He quit smoking 2 years ago. His medical history includes Type 2 diabetes, hyperlipidaemia, and severe fatty liver. Two years ago, he began experiencing severe coughing and expectoration following an episode of haemoptysis, for which he was diagnosed with chronic obstructive pulmonary disease (COPD) at a local hospital based on pulmonary function tests. He was treated for infection and discharged with symptom relief, regularly using the inhaler Symbicort. While the patient reported some improvement in symptoms, his cough continued unabated. A week ago, due to worsening cough and expectoration, particularly at night affecting his sleep, without haemoptysis but with chest tightness and shortness of breath, he revisited the local hospital. A chest CT scan revealed a thick-walled cavity in the right upper lobe, suggestive of an infectious disease (abscess or tuberculosis differential), with a tumour pending exclusion, accompanied by obstructive inflammation and atelectasis (Fig. 1). He was diagnosed with pneumonia and pending tuberculosis exclusion.

For further differential diagnosis of pulmonary pathogens, the patient was referred to our department. A comprehensive chest CT scan with and without contrast enhancement was performed. The results indicated: a calcified density obstruction seen at the opening of the right upper lobe bronchus, measuring approximately 6×10 mm, with reduced volume and streaky consolidations visible. The middle lobe showed cavity formation surrounded by multiple patchy, fuzzy shadows and thickened interlobular septa. The contrast-enhanced scan showed significant enhancement of the consolidation, right upper lobe inflammation, and a high probability of abscess formation (Fig. 2). Upon admission, the patient was treated with levofloxacin for infection, and a combination of budesonide and ipratropium bromide nebulisation to relax the airways.

To clarify the pulmonary pathology, a flexible bronchoscopy was performed along with bronchoalveolar lavage. During the procedure, a yellowish-white material was found almost completely obstructing the lumen at the opening of the right upper lobe (Fig. 4). We attempted to remove the foreign body using biopsy forceps under flexible bronchoscopy, but the surrounding granulation tissue was excessive, and the adjacent mucosa was oedematous, making the operation prone to bleeding. It was challenging to assess and remove the object under flexible bronchoscopy. Additionally, the patient exhibited softening and moderate to severe dynamic narrowing of the right main and intermediate bronchi during coughing (Fig. 3).

Following the procedure, a detailed patient history was revisited, where the patient recalled choking on a chicken bone two years ago, which was followed by haemoptysis and coughing. We considered the possibility of a bronchial foreign body. However, the overall relationship between the bronchi and the foreign body could not be fully visualised with flexible bronchoscopy. The bronchoalveolar lavage fluid culture yielded *Streptococcus pyogenes* (sequence count 2382), *Klebsiella pneumoniae* (sequence count 366), *Mycoplasma hominis* (sequence count 590), and *Pneumocystis jirovecii* (sequence count 489). Histological examination suggested a tumour at the opening of the right upper lobe consistent with chronic suppurative inflammation, showing extensive acute and chronic inflam-

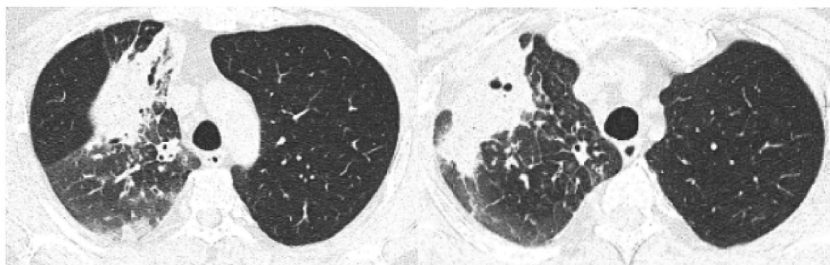


Fig. 1. Chest CT examination shows obstructive inflammation and atelectasis in the right upper lobe.

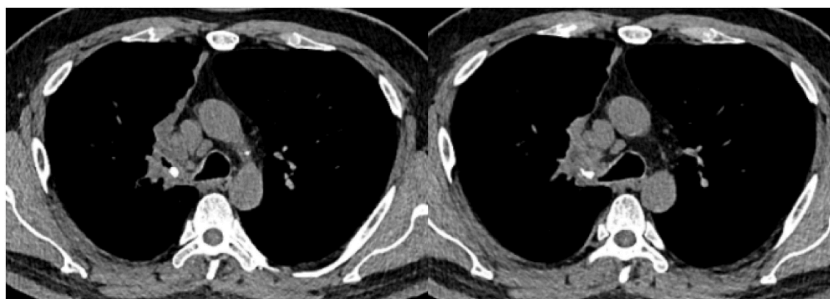


Fig. 2. Chest CT scan shows a calcified lesion at the opening of the right upper lobe bronchus.

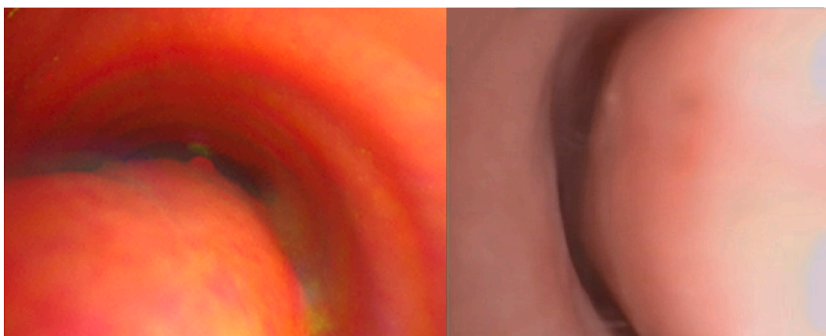


Fig. 3. Softening of the right main and intermediate bronchi.



Fig. 4. Foreign body obstruction at the opening of the right upper lobe.

matory cell infiltration and formation of inflammatory granulation tissue. Treatment was adjusted to levofloxacin combined with piperacillin sodium and tazobactam sodium for infection.

Two days later, we attempted to explore and remove the foreign body using a rigid bronchoscope. Under visualisation, a suspected bony foreign body was observed at the opening of the right upper lobe, surrounded by granulation tissue. Biopsy forceps and hot biopsy were used to clear the granulation tissue. The mucosa around the foreign body was prone to bleeding. Haemostasis was achieved using an argon plasma coagulation knife and hypertonic saline. Attempts to remove the foreign body with forceps, snare, and cryoprobe were unsuccessful. Ultimately, a double-jointed retrieval forceps was used to successfully hook and extract the foreign body, which was a bone measuring $0.6 \times 1.2\text{cm}$ (Fig. 5).

Postoperatively, the patient was treated with nebulized inhalation, anti-infective therapy, and hemostatic treatment, resulting in an improvement in cough symptoms. Nine days later, a follow-up bronchoscopy revealed swelling and moderate stenosis at the opening of the right upper lobe bronchus, along with necrotic tissue (Fig. 6). The openings of each segment of the right upper lobe also showed swelling and mild stenosis (Fig. 7). Necrotic tissue was removed using disposable biopsy forceps, and local cryotherapy was administered.

Two days after the procedure, the patient's symptoms improved, and they were discharged in stable condition, with a rapid recovery observed. One month later, during a telephone follow-up, the patient reported almost complete resolution of symptoms such as coughing and hemoptysis. A follow-up chest CT was recommended to monitor the resolution of inflammation; however, unfortunately, the patient declined to return for the CT scan. During a one-year follow-up after surgery, the patient remained asymptomatic with no significant complications, indicating a favorable outcome.

3. Discussion

Foreign body aspiration is a life-threatening conditions, yet it is seldom covered in textbooks [3]. According to reports, airway foreign bodies can be categorised into organic materials (such as peanuts, peas, popcorn, and sunflower seeds) and inorganic materials (such as plastic caps, toy beads, pen tips, and thumbtacks), with organic materials accounting for 60%–81 % of cases, and inorganic foreign bodies less frequently reported at 6.5%–25 % of cases [4]. Among all reported cases of foreign body aspiration, we found that foreign bodies more frequently lodge in the right bronchus than in the left (71.5 % vs. 22.8 %), with the middle bronchus (27 %) and the right lower lobe (33 %) being particularly common sites, and only 5.7 % lodging in the trachea. Due to the more vertical and broader, shorter, and straighter course of the right bronchus compared to the left, most foreign bodies are more likely to be aspirated into the right side, particularly into the right lower lobe and the middle bronchus, with fewer occurrences in the right upper lung.

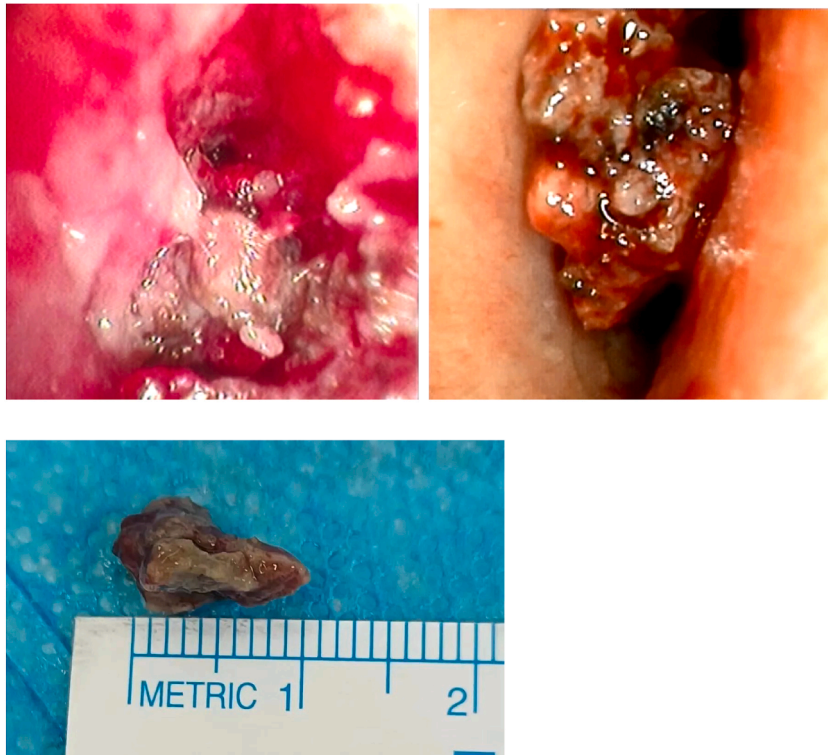


Fig. 5. Foreign body (chicken bone) removal during bronchoscopy.



Fig. 6. Necrotic tissue observed with stenosis at the opening of the right upper lobe.

Following foreign body inhalation, patients commonly present with sudden, severe paroxysmal coughing, which may be accompanied by breath-holding, hoarseness, cyanosis of the lips and face, and varying degrees of inspiratory difficulty. Most patients seek immediate medical attention after the aspiration event, and the diagnosis is typically straightforward based on the patient's history. However, some patients may exhibit atypical symptoms depending on the size of the foreign body and its location [5], which might only manifest as coughing [6], or wheezing, dyspnoea, chest pain, and haemoptysis, thus easily misdiagnosed as bronchitis, asthma, acute exacerbation of COPD, or vocal cord dysfunction [7]. For instance, Muramatsu et al. reported a case of an 84-year-old patient with chronic obstructive pulmonary disease who was ultimately diagnosed with pea aspiration after initially being thought to have tumour-induced airway obstruction [8]. Ramchandani et al. reported an incidental intraoperative diagnosis of a residual foreign body

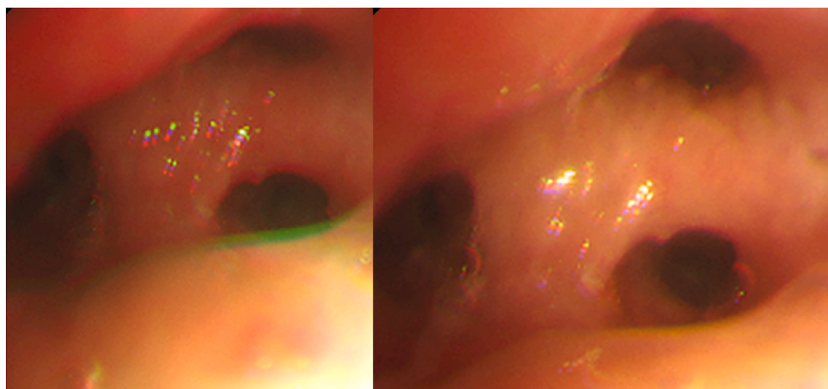


Fig. 7. Swelling and mild stenosis at the openings of each segment of the right upper lobe.

(plastic whistle), initially misdiagnosed as tuberculosis, interestingly, in a patient who also had tuberculosis [9]. There are also reports of FBA patients being misdiagnosed with other conditions, including asthma, tumours, and pulmonary eosinophilia [10].

If diagnosis is delayed, unrecognised and retained pulmonary foreign bodies can lead to severe complications [11]. Foreign bodies that remain in the bronchi for an extended period can irritate the local mucosa, causing inflammation and oedema, leading to granulation tissue proliferation that embeds and covers the foreign body and obstructs the bronchial openings, potentially causing pulmonary inflation insufficiency or atelectasis [12]. The granulation tissue anchors the foreign body to the airway walls, making removal more difficult and carrying risks of bleeding and airway damage. Furthermore, impaired drainage of secretions from the distal airways can lead to recurrent infections at the same site, resulting in obstructive pneumonia [13].

Therefore, for patients presenting with persistent cough, recurrent pneumonia, especially those who have not responded well to long-term anti-inflammatory treatments, and cases of unexplained emphysema or atelectasis, the possibility of an airway foreign body should be considered, even in the absence of risk factors. Early bronchoscopic examination is advisable to determine the presence of any airway foreign bodies. Bronchoscopy provides a direct visual assessment, allowing observation of the foreign body and tissue reactions to it, including granulation tissue, bronchial narrowing, or oedema, and is critical for identification and removal of the foreign body [14].

In this case study, a patient who had been repeatedly coughing for over two years was misdiagnosed with chronic obstructive pulmonary disease (COPD). A chest CT revealed a calcified density obstruction at the opening of the right upper lobe bronchus, with cavity formation observed in the middle lobe. Given that tuberculosis typically affects the right upper lobe, the initial assumption was that this was a tuberculous calcification. However, it was discovered during bronchoscopy that the actual cause was a foreign body. The first attempt to remove the foreign body with a flexible bronchoscope was unsuccessful, but it was finally extracted successfully under rigid bronchoscopy during the second attempt. Sharp foreign bodies, such as fish bones or chicken bones, tend to lodge in the tonsils, base of the tongue, or the pyriform sinus, and rarely migrate to the laryngopharynx or lower respiratory tract. Due to gravitational effects, foreign bodies usually accumulate in the right middle lobe and the basal segments of both lower lobes, with fewer instances in the right upper lobe, possibly due to the higher opening position of this lobe. In this patient, airway softening and excessive collapse of the airway during coughing caused the foreign body to be propelled to the opening of the right upper lobe, making it extremely difficult for the patient to expel the foreign body through coughing alone. The foreign body had been lodged in the right upper lobe for a long time, causing obstructive pneumonia. Once the foreign body (FB) was removed, both the recurrent coughing and the obstructive pneumonia were completely resolved.

4. Conclusions

While case reports of bronchial foreign bodies are not uncommon, reports of foreign bodies in the right upper lobe airway are rare. Here, we describe a successful removal of a foreign body that had been lodged in the right upper lobe airway for two years. Understanding the presentation, evaluation, and management of patients with airway foreign bodies is crucial for clinicians. Healthcare providers should remain vigilant, in patients highly suspected of having a bronchial foreign body, early bronchoscopy should be considered, minimize the rates of missed and misdiagnosed cases. If the foreign body has been embedded for an extended period, resulting in significant granulation tissue growth under endoscopic view, difficulty in removal, bleeding, perforation, and the risk of airway-esophageal fistulas, staged procedures may be advantageous in reducing risks.

This case exhibits several noteworthy characteristics: (1) Foreign bodies are commonly lodged in the right main bronchus and the bronchi of the right lower lobe. However, in this instance, bronchoscopy confirmed that the foreign body was lodged in the bronchus of the right upper lobe, which is clinically uncommon. (2) The appearance of the foreign body under bronchoscopy is related to the duration of inhalation. If a granuloma resembling a neoplasm is identified, and a hard foreign object is felt upon closing the biopsy forceps during the biopsy process—yet no tumour is proven—a second examination should be conducted to prevent misdiagnosis due to the foreign body being embedded within the granuloma. (3) Removing granulation tissue to extract the foreign body and relieve airway obstruction requires a lengthy procedure involving multiple instruments and can be highly stimulating for the patient, making

it unsuitable for routine bronchoscopic handling. Therefore, performing the removal under general anaesthesia with tracheal intubation is a safe and [15] reliable method.

CRediT authorship contribution statement

Ying Guan: Writing – original draft. **Tongshuo Yang:** Writing – review & editing. **Xiaoke Chen:** Resources, Conceptualization. **Peng Zhuang:** Formal analysis. **Yiliang Li:** Methodology. **Li Li:** Formal analysis.

Declaration of competing interest

No conflict of interest exists in the submission of this manuscript and manuscript is approved by all authors for publication. I would like to declare on behalf of my co-authors that the work described was original research that has not been published previously, and not under consideration for publication elsewhere, in whole or in part.

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