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Removal of a Bronchial Foreign Body by Bronchoscopic Cryotherapy: A Case Study

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A foreign body in the airway can be a potentially life-threatening event. The diagnosis and treatment of foreign bodies in the airway are a challenge for otolaryngologists. Despite the improvements in medical care and public awareness, approximately 3,000 deaths occur each year from foreign body aspiration. A high degree of vigilance is required to ensure prompt treatment and avoid the complications of foreign body aspiration. The author encountered a case of a 77-year-old female patient who had aspirated an unknown foreign body that was fixed in her main bronchus. An initial attempt was made to remove it with a flexible bronchoscope but failed due to the patient's hypoxemic state during the procedure. Under general anesthesia, a rigid bronchoscopic examination was performed, but it was difficult to approach the object due to the bronchus curvature. Instead, a cryotherapy instrument of bronchoscopy was applied. The foreign body was frozen and removed to the carina, where a laryngoscope and laryngeal forceps were used to remove it.

Key words

Cryotherapy; Foreign body; Bronchoscope; Laryngoscope

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INTRODUCTION

Adult foreign body aspiration (FBA) typically presents with a choking event followed by persistent coughing but not uncommonly, it can mimic more chronic diseases such as chronic obstructive pulmonary disease, asthma, and obstructive pneumonia when the initial event goes unnoticed (for example in elderly patient with an altered mental status).¹ When an accurate diagnosis is not established immediately, entrenched foreign bodies (FBs) may lead to recurrent pneumonias, bronchiectasis, recurrent hemoptysis, pneumothorax, lung abscesses, pneumomediastinum and other complications.^{2,3} Extraction of aspirated FBs should be undertaken as soon as possible in order to alleviate acute symptoms and prevent long term complications.⁴

This is a report of a 77-year-old female, who initially manifested dyspnea, fever and sputum. These are common symptoms of pneumonia but she turned out to have a FB in her left main bronchus. While examining and attempting to remove it, we applied several steps to approach it and in the end, we carefully removed it through

by flexible bronchoscopy, cryoprobe, and laryngeal forceps.

CASE REPORT

A 77-year-old woman was admitted to our emergency room with dyspnea. She had a history of marginal resection and colostomy due to sigmoid perforation in 2010, a takedown operation for colostomy repair in 2011, multi infarct dementia from 2014, and most recently, percutaneous coronary intervention at the mid left anterior descending coronary artery and asthma aggravation and pneumonia, in August, 2019. After discharge, she remained on in bed rest with her respiration assisted by oxygen (2 L/min) via nasal prong.

A week before, she had a fever up to 38.5°C and intermittent thick sputum. These symptoms worsened and eventually she had dyspnea. On examination, dyspnea was aggravated, and a steady increase of oxygen was needed to maintain saturation. Chest X-rays (Fig. 1A, B) and computed tomography (CT) scan (Fig. 1C, D) taken after admission showed signs of left pneumonia, but her

Fig. 1. Simple chest X-ray, anterior-posterior view, (A) Initial X-ray on Admission day and (B) Diffuse pneumonic infiltration in left after 2 days of admission. Chest computed tomography (CT), axial view showing ground-glass opacity at multiple sites as signs of pneumonia, unspecified, (C) CT obtained with mediastinal window setting (D) CT obtained with lung window setting.

symptoms did not improve even after changing intravenous antibiotics. She was moved to the intensive care unit from the general ward for close monitoring.

On the third day of admission, flexible bronchoscopy was done (Fig. 2A, B). A moderate amount of mucopurulent secretion was found in the right bronchial tree. Multifocal hyperemic edematous mucosal change was found in the right bronchial tree. We found a stone like FB at the orifice of left main bronchus, but failed to remove it, due to patient's immediate hypoxemic state (SpO₂ 88%, via HFNC FiO₂ 0.9) (Fig. 2C, D). She was referred to the otorhinolaryngology department for exploration and removal of the FB.

Under general anesthesia, a rigid bronchoscopic exam was done. There was FB material and pus at the left main bronchus as was seen in at previous flexible bronchoscopic exam (Fig. 3A), but we found it difficult to approach the FB due to the bronchus curvature. We then applied a flexible bronchoscope to fit in the bronchial curvature. Using a cryoprobe guided by the pulmonologist, an adequate approach to the lower tracheal level was achieved and the tip of the cryoprobe touched the surface of the FB

to freeze it (Fig. 3B). The FB material was carefully pulled out and disconnected from the cryoprobe at the carina. Removal was completed with using laryngeal forceps (Fig. 3C, D).

Four days later, the patient's vital signs were stabilized and follow-up rigid bronchoscopy was done. Multifocal hyperemic edematous mucosal change with erosion was found in the right bronchial tree. Similarly, multifocal hyperemic mucosal change was found in the left bronchial tree, as a sign of acute bronchitis. There were no other complications.

DISCUSSION

Aspiration of a FB is a potentially life-threatening emergency and 75% of cases occur in children younger than 3 years of age.⁵ FBA does happen in adults and elderly people as well.

Most adult patients with FBA have obvious risk factors for aspiration including neurological deficits with swallowing difficulties or altered mental status, neuromuscular disease, intoxication, or an iatrogenic cause. FB aspiration

Fig. 2. Bronchoscopy, (A) Mucopurulent secretion in the right bronchial tree, (B) Multifocal hyperemic edematous mucosal change in the right bronchial tree, partial exposure of foreign body (FB) fixed in the right bronchial tree Rigid bronchoscope, (C) Exposure of FB fixed in the right bronchial tree, (D) Trials of FB removal with laryngeal forcep.

Fig. 3. Flexible bronchoscope and cryoprobe, (A) FB stuck at left bronchial tree, (B) Successful cryoadhesion of the probe and the surface of FB, (C) Detached FB from cryoprobe at carina, (D) Completely removed FB, which later turned out to be an aspirated old dental metal filling material.

risk appears to increase with age. Iatrogenic FB aspiration in adults is most commonly related to dental procedures requiring local anesthesia and supine positioning, and is also associated with tracheostomy care.⁶

After FBA occurs, the FB can settle into 3 anatomic sites, the larynx, trachea, or bronchus. Of aspirated foreign bodies, 80 to 90% become lodged in the bronchi. In adults, bronchial FBs tend to be lodged in the right main bronchus because of its lesser angle of convergence compared with the left bronchus and because of the location of the carina left of the midline.⁷ Larger objects tend to become lodged in the larynx or trachea. In adults approximately 40% of FBs are found in the left bronchial tree and only 5 to 11% remain in the trachea.⁸

For examination, standard posteroanterior and lateral chest radiographs should be obtained in all patients where FBA is suspected. Radiographs directly identify FB in only 25% of patients, because only a small proportion of objects such as coins, nails, teeth, and dental appliances are radiopaque. Nonetheless, chest radiographs demonstrate indirect findings of atelectasis, hyperinflation, or

lobar consolidation in the majority of patients who have FBA.⁹

Chest CT is more sensitive for identification of FBs, helps with procedural planning, and has become the gold standard of imaging studies when a FBA is suspected.

The most important aspect of successful FB extraction is pre-procedural planning, considering the characteristics of the FB, its size, location in the airway, and the patient's comorbid conditions. In general, rigid bronchoscopy is preferred in cases of acute respiratory distress, while flexible bronchoscopy allows for a more comprehensive airway survey and has an overall 90% success rate for retrieval.^{10,11} In our case, the use of the flexible cryoprobe was shown to be very effective, for removing FB, especially as the FB had an organic portion with significant granulation tissue around it.¹²⁻¹⁴ In this technique, the cryoprobe is advanced towards the FB through the working channel. After contact, the probe is activated to rapidly freeze the object and cause it to adhere to the cryoprobe tip.^{15,16} Once cryoadhesion has occurred, the object can be gently removed from the airway. Care must

be taken not to touch the bronchial walls with the probe, as this can result in removal of bronchial tissue, bleeding, and rarely, airway perforation. The adherent ability of FBs is primarily based on their water content.¹⁰

After removal of the FB, it is imperative that the bronchoscopist performs a second airway survey for additional FBs and other side effects (such as granulation or bronchial stenosis).¹⁷⁻²¹

In summary, for patients with FBs in tricky positions in the trachea, a flexible cryoprobe can be an alternative way to remove them. We would like to report this rare case of using a cryoprobe for FB removal with the bibliography attached.

CONFLICT OF INTEREST

Seung Hoon Woo is the Editor-in-Chief of the journal but was not involved in the review process of this manuscript. Otherwise, there is no conflict of interest to declare.

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