Use of cryoprobe for removal of a large tracheobronchial foreign body during flexible bronchoscopy

Inderpaul Singh Sehgal, Sahajal Dhooria, Digambar Behera, Ritesh Agarwal

Department of Pulmonary Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh, India

ABSTRACT

Foreign body (FB) inhalation in the tracheobronchial tree is an infrequently encountered event in adults. The diagnosis is suspected in the presence of a clinical history of aspiration and the presence of respiratory symptoms. Management involves confirmation by flexible bronchoscopy, which may be both diagnostic as well as therapeutic. However, in certain situations including those with large FB, FB embedded in granulation tissue or FB with very smooth margins, rigid bronchoscopy may be superior to flexible bronchoscopy in the retrieval of the FB. An alternative to rigid bronchoscopy in such situations may be the use of a cryoprobe. Herein, we describe a patient with a large tracheobronchial FB causing a complete collapse of the left lung and hypoxemia. The FB was successfully extracted using a cryoprobe during flexible bronchoscopy, obviating the need for rigid bronchoscopy.

KEY WORDS: Anesthesia, bronchoscopy, foreign body, hypoxia, lignocaine, respiratory failure

INTRODUCTION

Tracheobronchial foreign body (FB) is a rare occurrence in adults with the proportion of flexible bronchoscopy performed as an indication for FB being as low as 0.24%. The most common type of FB in adults is inorganic (pin, needle, nail, screw, and others), and is usually visualized on a chest radiograph.[1] Treatment involves extraction of the FB using flexible bronchoscopy, which has a reported success rate of 90%. However, in certain instances (large FB, friable organic FB, FB embedded in the granulation tissue, FB in children, and in patients with respiratory failure), rigid bronchoscopy may be required for retrieving the FB. Another alternative in such situations may be the use of cryotherapy. Cryotherapy with cryoprobe freezes the concerned object or tissue, enabling quick, and easy removal.[3,4]

The use of cryotherapy has been described in the ablation of benign (granulation tissue, carcinoid, and airway strictures) and malignant (bronchogenic carcinoma, salivary gland tumors of the trachea) lesions of the airways, and for cryo-recanalization (restoring the patency of the airway by removal of the tumor).[4-7] Other uses include the performance of endobronchial and transbronchial lung biopsies and pleural cryobiopsies.[6,8-10] Cryoprobe has also been used for the extraction of tracheobronchial foreign bodies such as tablets, food particles, and blood clots using the technique of cryoextraction.[3,1,12] Herein, we describe the use of cryoprobe in the successful extraction of a large tracheobronchial FB during flexible bronchoscopy.

CASE REPORT

A 60-year-old male with no prior comorbid illness presented with breathlessness, cough, and wheezing of 10 h duration following accidental inhalation of the harad (Terminalia chebula) seed. On examination, he
was tachypneic, had audible wheeze with a room air oxygen saturation of 94%. Chest radiograph and computed tomography of the thorax revealed collapse of the entire left lung [Figure 1]. An urgent flexible bronchoscopy (Olympus, Tokyo; BF1T180; working channel diameter, 2.8 mm) was performed through the oral route under conscious sedation and continuous oxygen supplementation. Bronchoscopy confirmed the presence of a large FB in the left main bronchus with inspissated secretions [Figure 2]. Several attempts to dislodge the FB with the flexible grasping forceps and the Dormia basket were unsuccessful as the FB was fairly large [Figure 2]. A decision was then made to use the cryoprobe to extract the FB. The cryoprobe (ERBE, Tubingen, Germany; outer diameter 2.4 mm, length 780 mm) was introduced through the working channel of the flexible bronchoscope and was placed at the center of the FB, avoiding any contact with the surrounding mucosa. The cryoprobe was then frozen for 10 s, and the cryoprobe with the adhered FB was removed en bloc along with the flexible bronchoscope [Figure 3]. During the procedure, the oxygen saturation transiently dropped to 85% despite high flow oxygen supplementation (15 L/min). Following the procedure, the patient developed transient hypoxemia that was managed with supplemental oxygen inhalation (6 L/min), nebulization with salbutamol (2.5 mg) and systemic corticosteroids (100 mg of hydrocortisone). After 30 min, the patient was comfortable and was discharged after 6 h of observation.

**DISCUSSION**

The index case highlights the successful use of cryoprobe in the extraction of a large tracheobronchial FB during flexible bronchoscopy. Most adult patients present with innocuous symptoms due to the peripheral location of the FB. However, occasional patients may present with acute symptoms such as stridor, cough, wheeze, and respiratory failure in cases of a large FB that is located in the proximal airways. This was also highlighted in the index case that presented with acute symptoms and was found to have a large FB in the left main bronchus.

The diagnosis of an airway FB is made based on the history of aspiration and the clinical presentation with respiratory symptoms. The diagnosis is supported by chest imaging, either chest radiograph or computed tomography of the thorax. Imaging may either reveal a radio-opaque FB (metal pin, screw, and nail) or may manifest with indirect signs such as localized infiltrates, atelectasis of a segment or a lobe in the case of organic FBs. The index case had characteristic history and symptoms of FB inhalation and radiological feature of left lung collapse. The most common location of a tracheobronchial FB is the right lower lobe or the right intermediate bronchus due to the vertical orientation of the right main bronchus; however, it may also be seen in the other locations such as the left main bronchus as was the case in the index patient. The diagnosis is confirmed by flexible bronchoscopy that may also be used simultaneously for retrieving the FB, as was performed in the index subject. However, in certain situations as mentioned before, rigid bronchoscopy is preferred. In our patient, the FB was large and could not be grasped easily with the small shark tooth forceps or the Dormia basket during flexible bronchoscopy.

Cryoprobe has been used to extract large mucus plugs and blood clot that could not be removed using the flexible grasping forceps. Although endobronchial objects or foreign bodies with high water content are ideally suited for cryoextraction, recent evidence suggests that...
this technique can also be extended to extract inorganic objects with low water content.\textsuperscript{[11]} Cryoextraction has also been used in the removal of metallic and inorganic tracheobronchial FBs that are embedded in the granulation tissue.\textsuperscript{[15,16]} The presence of airway secretions and spraying of normal saline over the FB enables crystallization of the water molecules.\textsuperscript{[15]} This results in strong attachment of the cryoprobe to the FB leading to its successful removal, as demonstrated in our patient.

Finally, the use of cryoprobe is not without limitations. Although the cryoprobe enabled successful removal of a large airway FB, it resulted in hypoxemia both during and after the procedure that required supplemental oxygen and nebulized bronchodilatation. It is important to realize that patients with comorbid illness and those with low cardiorespiratory reserve may not tolerate even transient hypoxemia. In such cases, flexible bronchoscopy may not be safe, and one should directly resort to rigid bronchoscopy performed under general anesthesia.

**CONCLUSION**

A large tracheobronchial FB may occasionally be successfully removed with a cryoprobe during flexible bronchoscopy, precluding the need for rigid bronchoscopy and general anesthesia.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Sehgal IS, Dhooria S, Ram B, Singh N, Aggarwal AN, Gupta D, et al. Foreign body inhalation in the adult population: Experience of 25,998 bronchoscopies and systematic review of the literature. Respir Care 2015;60:1438-48.
2. Rafanan AL, Mehta AC. Adult airway foreign body removal. What’s new? Clin Chest Med 2001;22:319-30.
3. Sehgal IS, Dhooria S, Agarwal R, Behera D. Use of a flexible cryoprobe for removal of tracheobronchial blood clots. Respir Care 2015;60:e128-31.
4. Vergnon JM. How I do it bronchoscopic cryotherapy. J Bronchology Interv Pulmonol 1995;2:323-7.
5. Hetzel M, Hetzel J, Schumann C, Marx N, Babiak A. Cryorecanalization: A new approach for the immediate management of acute airway obstruction. J Thorac Cardiovasc Surg 2004;127:1427-31.
6. Rubio ER, le SR, Whatley RE, Boyd MB. Cryobiopsy: Should this be used in place of endobronchial forceps biopsies? Biomed Res Int 2013:2013:730574.
7. Schumann C, Hetzel M, Babiak AJ, Hetzel J, Merk T, Wibmer T, et al. Endobronchial tumor debulking with a flexible cryoprobe for immediate treatment of malignant stenosis. J Thorac Cardiovasc Surg 2010;139:997-1000.
8. Maturu VN, Sehgal IS, Dhooria S, Bal A, Aggarwal AN, Behera D, et al. Pleuroscopic cryobiopsy: Case series and systematic review. J Bronchology Interv Pulmonol 2015;22:e11-3.
9. Dhooria S, Bal A, Sehgal IS, Aggarwal AN, Behera D, Agarwal R. Transbronchial lung biopsy with a flexible cryoprobe: First case report from India. Lung India 2016;33:64-8.
10. Dhooria S, Sehgal IS, Aggarwal AN, Behera D, Agarwal R. Utility and safety of cryoprobe transbronchial lung biopsy in diffuse parenchymal lung diseases: Systematic review and meta-analysis. Respir Care 2016;61:70012.
11. Fruchter O, Kramer MR. Retrieval of various aspirated foreign bodies by flexible cryoprobe: In vitro feasibility study. Clin Respir J 2015;9:176-9.
12. Sriratanaviriyakul N, Lam F, Morrisse BNM, Stollenwerk N, Schivo M, Toneda KY. Safety and clinical utility of flexible bronchoscopic cryoextraction in patients with non-neoplasm tracheobronchial obstruction: A retrospective chart review. J Bronchology Interv Pulmonol 2015;22:288-93.
13. Chen CH, Lai CL, Tsai TT, Lee YC, Peng RP. Foreign body aspiration into the lower airway in Chinese adults. Chest 1997;112:129-33.
14. Casalini AG, Majori M, Anghinolfi M, Burlone E, D’Ippolito R, Toschi M, et al. Foreign body aspiration in adults and in children: Advantages and consequences of a dedicated protocol in our 30-year experience. J Bronchology Interv Pulmonol 2013;20:313-21.
15. Schumann C, Kropf C, Rüdiger S, Wibmer T, Stoißer KM, Lepper PM. Removal of an aspirated foreign body with a flexible cryoprobe. Respir Care 2010;55:1097-9.
16. Liu ZG, Tan JH, Zhang WD, Wu HQ, Deng HY. Foreign body removed by the ‘Fire and Ice Technique’: A case report. Respir Med Case Rep 2013;10:13-4.