Original Article

Bronchoscopic Airway Foreign Body Extraction without Using Optical Forceps

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INTRODUCTION

Airway foreign bodies (FB) are one of the most common pediatric surgical emergencies. The condition poses a life-threatening risk if not treated in time. Rigid bronchoscopy is the procedure of choice and the optical forceps (OF) available are capable of successfully retrieving the FB in the majority of cases. There are certain situations when retrieval by the available OF is difficult. These can be due to an impacted FB, smooth surface metallic objects such as lead pellets, glass beads, and distally migrated FB out of reach of OF. These circumstances pose a very desperate life-threatening situation, and the surgeon has to innovate on the spot to resolve the situation successfully. We present alternative methods of FB retrieval when the removal by OF fails, and the situation demands an immediate solution. The following case series presented involves removals of airway FB by alternative methods either due to OF failure or as a testing method under controlled situation. Recent available literature is also reviewed.

PATIENTS AND METHODS

This case series was a retrospective case review done for all patients who were admitted for airway FB from 2015 to 16. During this 2-year period, a total of 48 patients were admitted with foreign body (FB) aspiration and underwent bronchoscopy. These patients were admitted at emergency, and a chest X-ray was the only investigation done. Contrast CT was done if indicated for long-standing FB. The timing of bronchoscopy depended on the clinical situation of the child and varied from an hour to the next morning. The alternate procedures used were retrieval by dormia basket (DB), Fogarty’s catheter (FC), and magnet aided removal. The DB used was a 3.5 fr, 4 cm, and 3 loop/prong basket with length 45 cm. The basket was passed beyond the FB and opened and gently withdrawn.

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to trap the FB. Once the FB was inside the basket it was closed to have a soft but snug grip [Figure 1]. The entire scope with the basket was then removed to retrieve the FB. FC was used for disimpaction and safely dragging the FB in the trachea. Magnet aided removal was done with an outside placed magnet on the extended neck. This is described later. The choice of method of removal without OF was based on the difficulty in the removal and was decided by the surgeon on case by case basis.

**Results**

Totally 20 patients (6 females) were successfully scoped by the non-OFs method. The age ranged from 1.5 years to 12 years (mean 3.5 years). Three patients underwent CECT chest for diagnosis of longstanding airway FB. Five patients had a history of unsuccessful attempt at bronchoscopic retrieval done outside our hospital.

The removal was aided by DB in 13, FC in 6, and magnet aided removal in 1. FC used in some scenarios is described. First one being impacted FB where holding the FB with OF makes it either slip away and gets further impacted like a cork in a bottle. The FC tip was made to pass beyond the FB, and the balloon was inflated, and the catheter was gently withdrawn. The bulb of the FG then pushes the FB from behind (push rather than pull) dis-impacting it from the narrow airway and then pushing it toward the main stem from where it is retrieved safely by OF. In the second case, FC was used in a perforated glass bead where the bead was a part of a necklace. FG was made to pass through the central hole of the bead, and then the balloon was inflated to lock the beat with the FC and retrieved. The nature of FB retrieved was nuts and vegetables in 13, metallic and toy parts in 6, and a large magnet in complete removal was achieved in all patients.

**Discussion**

The pediatric surgery emergency has a regular input of patients with FB bronchus. The patient is usually a curious toddler who tends to pick and chew on small objects while playing. It has been reported that 75.4% of aspiration cases occur in children less than 3 years old with a predilection to males.[1] Complications such as persistent cough, pneumonia, and bronchiectasis are more common if the diagnosis is made a month after aspiration.[2] Mortality is also reported due to an FB aspiration.[3]

Rigid bronchoscopy remains the gold standard for the removal of FB from the tracheobronchial tree under direct vision.[4,5] The availability of good quality OF has increased the success in bronchoscopic retrieval, but it has its own limitations. Inability to ventilate during the passage of the instrument and reduced vision in terms of optical quality are some limitations, in addition to what has been mentioned earlier. There are conditions when the surgeon needs some other resource for emergency rescue.

The study outlines the use of DB, FC and magnet as alternative method of FB retrieval when OF fails to do so and creates a desperate life-threatening situation. DBs have been used rarely to extract FB bronchus. There have been 4 previously published reports of isolated cases, the earliest being in 1971.[6‑9] 13 of our patients were successfully treated using a DB which is the largest series of patients in the pediatric population till date. Complications include mucosal trauma and pneumothorax due to forceful insertion of basket. In our patients, no complications happened.

FC was first used to extract FB bronchus in 1968. It has also been used in the removal of FB from the esophagus,[10] urethra,[11] and nose.[12] We have used FC in 6 of our patients. We encountered no complications in any of our cases. A retrospective analysis of 26 pediatric FB removed with bronchoscopic FC by Chen et al. concludes it to be a safe, effective, and easily performed method.[13] Risks of using FC include catheter disruption, tip dislodgement, and airway damage.

An interesting case was of an 8-year-old boy who had swallowed a large magnet which was impacted in his right main bronchus. There was a previous failed attempt at bronchoscopic removal before referral. On bronchoscopy, the magnet was impacted like a cork in a bottle, and its smooth wall was not amenable to be held by OF. Situations like the one above compel the surgeon to be creative and resourceful. A magnet was used externally on the chest wall [Figure 2]. The FB within continued to be under bronchoscopic vision, and it could be seen walking along the bronchus without any assistance from an instrument within. At the laryngeal inlet, it was extracted by a Magill’s forceps. The use of a magnet to remove an FB was first reported way back in 1904 by way of a tracheotomy.[14]
With the given experience we recommend that the FC DB and magnet should form an indispensable part of bronchoscopy set. The use of these alternative methods is successful and allows ventilation during the removal in contrast to removal by OF. These should be kept as an option if retrieval is difficult.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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