



The efficacy and safety of airway foreign body removal by balloon catheter via flexible bronchoscope in children – A retrospective analysis



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ABSTRACT

Objectives: To investigate the efficacy and safety of the airway foreign body removal by balloon catheter via flexible bronchoscope in children.

Methods: Retrospective analysis was performed of 26 cases of airway foreign body removal in children by balloon catheter via flexible bronchoscope in the First Affiliated Hospital of Guangzhou Medical University between December 2006 and December 2014.

Results: There were 14 males and 12 females, aging between 1 and 12 years (median age: 25 months). The clinical course ranged from 0.5 h to 60 days (median: 3 days). The foreign bodies consisted of peanuts (16 cases), soybeans (3 cases), pumpkin seeds (3 cases), porcine bone (1 case), olive nut (1 case), and a plant-based object (1 case). All foreign bodies were successfully removed. The operation duration ranged from 3 to 15 (5.3 ± 2.9) min. No complication was observed such as hemorrhage, pneumothorax, or airway laceration.

Conclusions: Balloon catheter via flexible bronchoscope is a safe, effective, and easily performed method of removing airway non-sharp foreign bodies in children.

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1. Introduction

Airway foreign body (FB) is a life-threatening emergency commonly seen in children. In the United States, airway FB accounted for 12% of toy-related hazards [1] and 7% of accidental deaths in children less than 4 years of age [2]. Delayed diagnosis of airway FB increased mortality. It is therefore critical to efficiently diagnose and remove foreign bodies to prevent adverse complications. To date, flexible bronchoscope has been widely used as a method of choice in childhood airway FB removal. Aided by the flexible bronchoscope, foreign bodies can be collected using biopsy forceps, snares, and baskets [3–6]. To our knowledge, no published papers have described the airway FB removal via the balloon method. The rationale of airway FB removal with balloon catheter: The fully collapsed balloon catheter was advanced through the FB via the bronchoscope. The distal balloon was inflated with gas

injection according to the diameter of the surrounding airway and the FB was removed as the balloon catheter was withdrawn. In this report, we retrospectively analyzed 26 childhood airway FB cases treated by the balloon method with flexible bronchoscope to discuss the efficacy and safety of this method.

2. Materials and methods

2.1. Patients

26 children with airway FB treated with balloon method via flexible bronchoscope between December 2006 and December 2014 in the First Affiliated Hospital of Guangzhou Medical University were recruited in our study. Data were collected including sex, age, clinical signs, clinical course, etiology, FB type, number, location, operation time, and complications were analyzed. The indications of the choice of balloon method included (1) aspiration of non-sharp objects, especially soft, fragile objects that were difficult to clamp; (2) a clear passage between the object and airway to allow the passing through of the balloon catheter. All the guardians of patients signed the consent, and the study was

Abbreviations: FB, foreign body; OD, outer diameter.

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approved by the Ethical Committee of the First Affiliated Hospital of Guangzhou Medical University.

3. Operation procedure

3.1. Preoperative preparation and anesthesia

The procedure was performed in the operating room for all patients. Anesthesia was induced by propofol 2–2.5 mg/kg, sufentanil 0.3 μ g/kg, and cisatracurium 0.1 mg/kg. A laryngeal mask appropriate to the age and weight of the patient was applied and connected to the ventilator. Anesthesia was maintained by propofol 4–10 mg/kg/h and sufentanil 0.05–0.2 μ g/kg/min. Vital signs were monitored during the operation. We took a rigid bronchoscope as back-up.

3.2. Physical examination and evaluation

Patients were examined by interventional pulmonologist with flexible bronchoscope (BF-P260f, BF-260, or P3C30) (Olympus, Japan) to determine the type, shape, and location of the FB.

3.3. The removal of FB

The examination was performed using the balloon catheter apparatus (Disposable balloon catheter, B5-2C, Olympus, Japan, Fig. 1A and B, FDA-approved no.: K962901) and the air volume-to-balloon diameter relationship was determined in vitro with a maximum air volume of 2.1 ml. In case the inflated balloon lodged in the trachea and dysfunctioned, a needle is available to puncture the balloon in that scenario. The fully collapsed balloon was advanced through the distal end of the FB via the bronchoscope. The balloon was inflated with gas injection according to the diameter of the surrounding airway and the balloon was slightly moved to determine whether it could remove the FB. The balloon was further inflated if it failed to drag the object, while the balloon was deflated if it created friction. The FB was retracted to the glottis level and taken out together with removal of the laryngeal mask (Fig. 2A–F, Video 1). The mask was re-inserted to examine residual objects and airway damage. If the objects are at the bronchus, balloon catheter should be positioned in the center of the airway. This may prevent the objects from falling into the contralateral bronchus at the carina level. When the FB is moved to the trachea

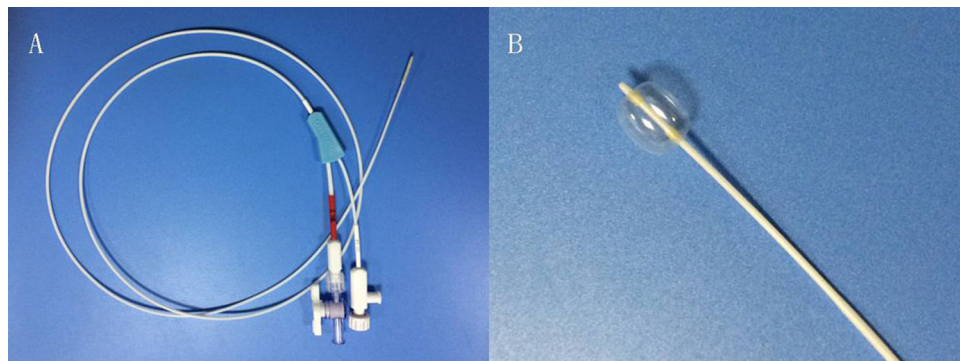


Fig. 1. Disposable balloon catheter. (A) The deflated balloon catheter; (B) the inflated balloon.

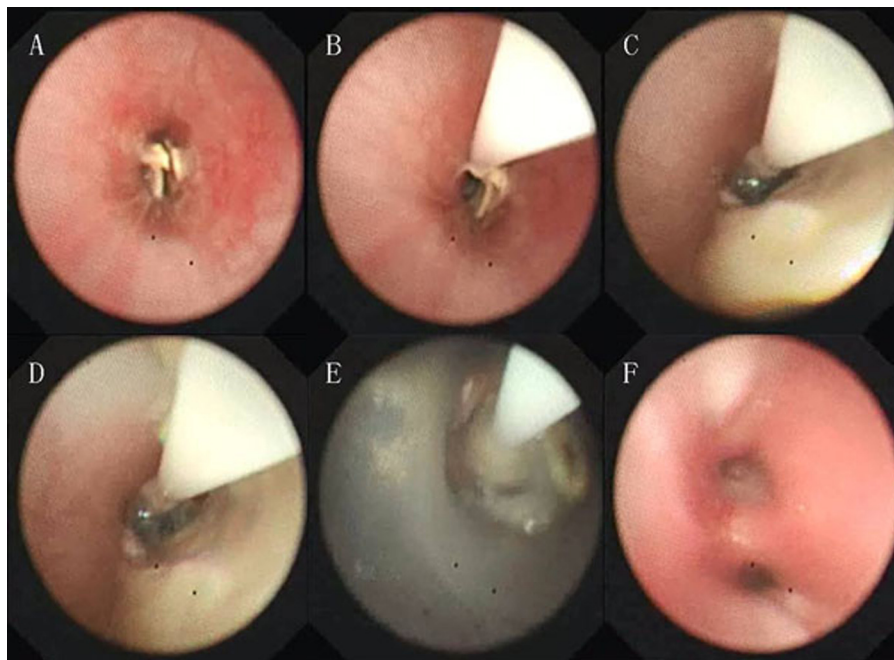


Fig. 2. The procedure of the airway foreign body removal. (A) The object (a pumpkin seed) in the left main bronchus; (B) the fully collapsed balloon catheter was advanced to the distal end of the foreign body; (C) the balloon was expanded with gas injection according to the diameter of the surrounding airway; (D) the foreign body was removed by the balloon catheter; (E) the foreign body was retracted to the glottis level and taken out together with removal of the laryngeal mask; (F) re-examination of the left superior and left inferior bronchus after the foreign body removal.

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