



Inhaled foreign bodies in pediatric patients: Review of personal experience

Francesca Pinzoni^a, Corinna Boniotti^a, Silvana M. Molinaro^a,
Adriana Baraldi^a, Marco Berlucchi^{b,*}

^a Department of Pediatric Anesthesia, Spedali Civili, Brescia, Italy

^b Department of Pediatric Otorhinolaryngology, Spedali Civili, Piazza Spedali Civili 1, 25123 Brescia, Italy

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Summary

Background: Foreign bodies (FBs) are a life-threatening event in children that require early diagnosis and prompt successful management. The ideal means of FB removal is rigid bronchoscopy under general anesthesia, although the choice between spontaneous or controlled breathing and the type of drug used are still subjects of discussion. We made a review of the literature and report our experience on FB inhalation, nature and location of FB, diagnostic method, prediction, perioperative complications, type of anesthesia, ventilation and total duration of the surgical procedure.

Methods: Forty-six children undergoing rigid bronchoscopy for suspect FB aspiration were retrospectively assessed. Relevant clinical and radiological findings were retrieved. During endoscopic procedures induction and maintenance of anesthesia were performed by intravenous or volatile drugs associated with topical airway lidocaine under spontaneous breathing.

Results: The most common symptoms were cough and dyspnea. Radiological examination was beneficial in 34 patients. At bronchoscopy, organic and inorganic FBs were located largely in bronchial tree and removed in 40 of the 46 children. All patients maintained spontaneous ventilation using volatile and intravenous anesthesia in 22 and 24 children, respectively. The mean surgical time was 79 min. Perioperative complications such as bronchospasm, bleeding and desaturation were observed in five patients.

Conclusions: FB inhalation is an uncommon life-threatening event in pediatric patients that can manifest with various symptoms. Rigid bronchoscopy is the procedure of choice for diagnosis and management of FB inhalation in pediatric patients. Spontaneous ventilation can be considered safe, using either volatile or intravenous

* Corresponding author. Tel.: +39 0303996226.
E-mail address: marco.berlucchi@tin.it (M. Berlucchi).

agents. Perioperative complications were not correlated with either the choice of agent (volatile or intravenous) or the duration of surgery. A close collaboration between anesthesiologists and otorhinolaryngologists and a long-standing experience in pediatric airway emergencies are the key factors for obtaining good results.

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1. Introduction

Foreign body (FB) inhalation is an uncommon life-threatening occurrence in young children. In the USA, about 300 children per year as caused by FB inhalation, which accounts for 7% of deaths in children younger than 4 years of age [1]; in Italy, about 400 pediatric FB inhalations occur yearly [2–4].

Early diagnosis associated with prompt successful treatment is mandatory for management of FB inhalation. FB suspicion is initially based on clinical history, symptomatology, objective chest evaluation [5,6], X-ray and fluoroscopy of the airway [7–9]. Definitive diagnosis is provided by bronchoscopy [10,11], whereas the FB is ideally removed using a rigid bronchoscope [12–14].

Such a surgical technique can be somewhat complex, and a procedure that is not meticulously performed can lead to several critical perioperative complications. For these reasons, it is fundamental that only qualified physicians carry out bronchial endoscopy and moreover, cooperation between an experienced anesthesiologist and a qualified pediatric otorhinolaryngologist are fundamental in order to obtain successful results.

Although it is clear that the treatment of FB inhalation is achieved in the operating room or in an endoscopy unit under general anesthesia, and by rigid bronchoscopy [15,16], the choice of anesthesiological technique (spontaneous respiration or the administration of a muscle relaxant associated with controlled respiration) is still actively discussed [10,17–19]. Herein, we report our experience on FB aspiration in pediatric patients, in particularly perioperative complications correlated to type of anesthesiological agent and duration of surgical procedure were analyzed.

2. Methods

The clinical records of patients with suspicious FB inhalation observed at the Departments of Pediatric Anesthesiology and Pediatric Otorhinolaryngology, Spedali Civili, Brescia, Italy during the period from January 1998 to November 2005 were retrospectively reviewed. For each anesthesiological and surgical procedure, informed consent was obtained by parents or legal tutors.

Relevant clinical findings (age, gender, signs and symptoms, duration of clinical picture, type and location of FB), radiographs of airway, anesthesiological technique, rigid bronchoscopy, perioperative complications such as bronchospasm, desaturation ($\text{SpO}_2 < 85\%$) [20], bleeding, re-intubation and hospital stay were retrieved. Moreover, the total duration of the surgical procedure (anesthesiological plus surgical time: short procedure ≤ 60 min; long procedure > 60 min) was also evaluated.

All children underwent diagnostic and operative rigid bronchoscopy. When identified, the FB was removed using rigid bronchoscopes (Storz) equipped with optic telescopes (Hopkins). Alligator or peanut-type forceps were used as needed to grasp the FB. The size and length of instruments were related to the age and weight of each child.

All children were premedicated with atropine intravenously (0.01 mg/kg). The surgical procedure was always performed in the operating room under general anesthesia associated with local anesthesia of the airways. All patients were continuously monitored for heart rate, electrocardiography, pulse oximetry and noninvasive blood pressure at 5 min intervals. Induction was performed using propofol (3 mg/kg) and/or sevoflurane inhalation using a mask (from a 2% minimum). The vocal cords and trachea were sprayed with lidocaine 1% (3–5 mg/kg) under direct laryngoscopy.

During endoscopy, all children were always in spontaneous respiration and breathed with high rates of oxygen ($> 50\%$) through a Waters circuit connected to the side arm of the rigid bronchoscope. Anesthesia was maintained with propofol (from 6 to 10 mg/(kg h)) associated with remifentanyl (0.02–0.2 mcg/(kg min)) or sevoflurane in increasing doses (from 2 to 8%) associated with remifentanyl (0.02–0.2 mcg/(kg min)) or fentanyl (2–3 mcg/kg).

2.1. Statistical analyses

Correlations between perioperative complications and the type of maintenance anesthesia (intravenous or volatile anesthesia) or total duration of the surgical procedure were assessed. All analyses were performed using a Student's *t*-test or a χ^2 -test. A *p* value ≤ 0.05 was considered statistically significant.

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