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Questioning the legitimacy of rigid bronchoscopy as a tool for establishing the diagnosis of a bronchial foreign body

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ABSTRACT

Objectives: Rigid bronchoscopy (RB) is the principal method used for the extraction of a tracheobronchial foreign body (FB), but its use as a diagnostic tool implies a certain rate of negative exams, exposing the child to the risk of procedure and anesthesia-related complications. Technological progress has improved the accuracy and availability of non-invasive modalities, such as CT scan and fluoroscopy. Our aim is to review our experience in the routine use of bronchoscopy for a suspected FB aspiration, and evaluate the adequacy of our current attitude in light of these alternatives.
Methods: We performed a retrospective review of cases where bronchoscopy was used in the management of a suspected airway FB, and analysis of the correlation between the clinical and radiological data and the bronchoscopy's results. In addition we reviewed the literature concerning the use of RB and alternative means of diagnosis such as CT scan, fluoroscopy and flexible bronchoscopy.
Results: Thirty-two patients underwent bronchoscopy to rule out a FB aspiration under general anesthesia. No FB was found in 8 cases (25%). Cough and a history of choking were the most sensitive parameters (sensitivity 100% and 80% respectively), but had a low specificity. Stridor was the most specific sign (88% specificity), but was not sensitive. Chest radiography had 25% sensitivity, and 62.5% specificity. Flexible bronchoscopy changed the management in 22% of cases, sparing RB.
Conclusions: Basing the decision to perform RB solely on the clinical findings and chest radiography entails a 25% rate or more of negative exams. CT scan appears to be the most accurate non-invasive tool for ruling out the presence of a FB but its use cannot be systematic due to its complexity and the risks of exposure to radiation. Digital substraction fluoroscopy is a safe and simple mean to confirm the presence of air trapping generated by a bronchial obstruction, but it is not sensitive enough to definitively rule out a FB. We propose a stepwise approach using fluoroscopy or possibly flexible bronchoscopy under sedation, in order to reduce the number of negative RBs while restricting the use of the CT scan.

1. Introduction

For more than 30 years, rigid bronchoscopy (RB) has been the major tool for ruling out or extracting an airway foreign body (FB), and many articles in the 1980s and 90s describe its utility and merits. However, in the last decade the number of published series has declined and more specifically, no North American institute has published its data regarding the use of RB or alternative methods for establishing the diagnosis of a FB. Meanwhile, considerate progress has been made with regards to CT scans or "virtual bronchoscopy", digital substraction fluoroscopy and flexible endoscopy. Publications, mainly in the radiological literature, demonstrate the important contribution that those means could have on the decision-making process, potentially refining the sensitivity and specificity of the diagnosis as an intermediate stage prior to RB.

In our university hospital, whenever the suspicion of a FB aspiration is strong enough based on clinical evaluation and chest radiography, the child is referred to bronchoscopy under general anesthesia without further imaging. Consequently, in cases where a FB is not found, RB assumes only a diagnostic role with no therapeutic utility. However, RB is an intrusive exam with possible complications. The main perioperative complications are bronchospasm, desaturation and trauma to the respiratory tract with bleeding or edema, occurring in 8–17% of cases [1–3]. Rare complications that have been described include pneumothorax/mediastinum, need for tracheotomy, cardiac arrest and even death. A recent review of the anesthetic considerations of RB by Fidkowski et al. approximated the prevalence of major morbidity and mortality as 0.9% and 0.5%, respectively [4]. Many of these complications are possibly attributable to the presence of a FB and the patient's state, and it is difficult to single out those that are due

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to the procedure itself, or that have occurred during unnecessary exams.

In this study, we review and analyse our institutional experience in the management of suspected airway FBs. In addition, we review the published literature in order to evaluate the usefulness of alternative methods for establishing a diagnosis. Finally, we propose a step-wise approach aimed at decreasing the number of general anesthesia cases, and selecting those patients who will require CT scan.

2. Methods

All the cases of flexible or RB performed in our pediatric tertiary care center from April 2007 to November 2009, for the purpose of ruling out a FB aspiration, were retrospectively reviewed using a database (Access, Microsoft Inc.). Two cases were excluded since the bronchoscopies were done as part of an exhaustive investigation for chronic lung pathologies.

Collected data from our chart review included demographic parameters (age, gender, co-morbidity, concomitant URTI, duration of symptoms, and hospitalisation time), symptoms (event witnessed or not, cough, and dysphagia), auscultation signs (decreased breath sounds, wheezing, stridor, and rales), radiological information on PA or lateral recumbent radiography (obstructive emphysema, shift, atelectasis, and opacification) and operative data (bronchoscopy type, FB type and location, other findings, and complications).

All chest X-rays were reviewed by a senior radiologist blinded to the clinical data and operative findings.

Both flexible and RB were performed in the OR under general anesthesia by either a senior otolaryngologist, a senior pulmonologist or both. Whenever the situation was considered urgent for respiratory stability and/or the clinical findings were obvious, RB was performed. In the rest of the cases, flexible bronchoscopy was first used to assess the diagnosis and location of the FB. All FB were removed by RB.

3. Results

Thirty-two patients aged from 9 months to 13.7 years (mean 3.3 years, Table 1) who underwent bronchoscopy, either rigid or flexible, for the purpose of ruling out a FB aspiration were included in the study. A FB was found in 24 cases (75%). Among the 8 negative bronchoscopies there were 3 cases of spontaneous expulsion of the FB prior to exam, 4 cases of inflammatory disease and 1 normal exam (Fig. 1).

No demographic or clinical parameter was found to be both sensitive and specific for the presence of a FB. Cough and a history of choking were the most sensitive parameters (sensitivity 100% and 80%, respectively) and stridor was the most specific sign (88% specificity). The combination of a witnessed choking event with acute symptomatology, with no associated upper respiratory tract infection (URTI), asthma or fever, predicted a positive bronchoscopy in 14 out of 14 cases (Table 2).

Chest radiography was interpreted as higly suspicious of FB aspiration in 9 cases, 6 of which were true positives (sensitivity 25% and specificity 62.5%). In 14 cases the interpretation of chest radiography was of "low suspicion", but in 10 of these cases a FB was eventually found during bronchoscopy.

Flexible bronchoscopy was initially performed in 13 out of 32 cases. In 6 of these cases a FB was found and promptly extracted by

Table 1
Patients information.

	Total number	Foreign body	No foreign body
Total number of patients	32	24	8
Age	3.3 years (9 months–13.7 years)	3.3 years (9 months–13.7 years)	2.7 years (9 months–6.9 years)
Gender	19 males	15 males	4 males
	13 females	9 females	4 females
Co-morbidity	4 asthma	2 asthma	2 asthma
Concomittant URTI	9	6	3
Time from aspiration to bronchoscopy	8.5 days (0–90 days)	8.7 days (0–90 days)	5.9 (0–30 days)
Duration of hospitalisation	2.8 days (0–20 days)	2.9 days (0–20 days)	2.1 days (0–4 days)

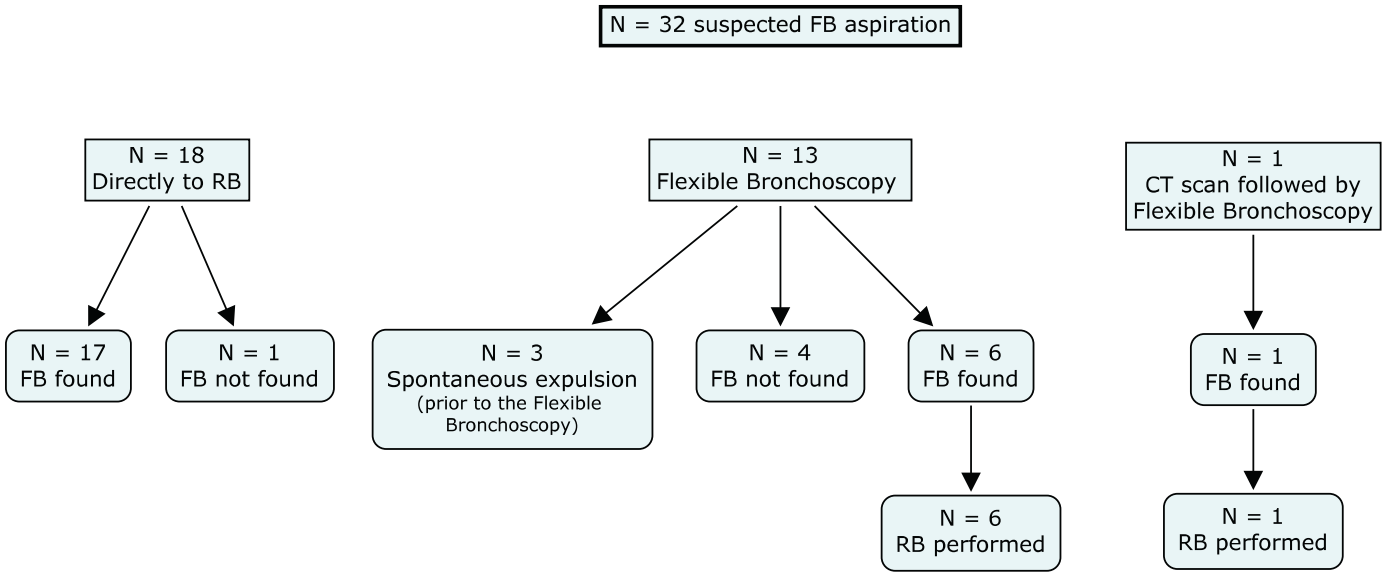

Fig. 1. Study patients distribution.