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Bronchoscopic removal of tracheobroncheal foreign bodies: value of patient history and timing

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Abstract Between 1990 and 1999, 741 bronchoscopic procedures were performed in 698 children, 594 of whom were evaluated for foreign-body aspiration (FBA) (mean age 3.9 years, male:female 287/307). Based on the presenting symptoms, clinical outcome, and complications, two major groups were identified. Group 1 consisted of 438 patients with a definitive history of FBA. Most were admitted soon after the aspiration with sudden onset of symptoms such as coughing, choking, wheezing, and respiratory distress. Group 2 comprised 156 patients with chronic pulmonary infections and/or atelectasis without a definitive history of FBA. The most common radiographic finding was emphysema of one lung in group 1 (61.1%) and pneumonia in group 2 (70%). Among the patients in whom a FB was removed, the percentage of normal radiography was 17%. The FB was identified and removed in 83% of cases in group 1. The complication rate in this group was 9.8%, and all the complications were treated medically. Only 2 patients required intercostal drainage. In group 2, a FB was identified in 25% of bronchoscopic examinations and 17% of the patients developed complications. One of these patients underwent an urgent thoracotomy due to bilateral tension pneumothoraces and 2 required tracheostomies. Patients with a definitive history of FBA, even with a normal physical examination and radiographic findings, must undergo bronchoscopic investigation. Cases with late presentation and chronic pulmonary infection are at high risk. In this group care should be take in determining the indication and timing of bronchoscopy in order to prevent life-threatening complications.

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Introduction

A foreign body (FB) in the airway requires prompt removal as it may result in acute respiratory distress, atelectasis, and even sudden death [1, 3]. In addition, in some patients with chronic pulmonary symptoms without an obvious history of aspiration, a FB may be the cause and removal may be curative. Recent improvements in anesthesia and equipment have allowed bronchoscopy to be a safe and simple diagnostic and therapeutic procedure in experienced hands [1, 3, 4]. A review of our experience was undertaken to evaluate the effectiveness and complications of bronchoscopy in the treatment and differential diagnosis of FB aspiration (FBA).

Patients and methods

Between 1990 and 1999, 741 bronchoscopic procedures were performed in 698 children. A FB in the airway was the most common indication (594 patients), the others being tracheoesophageal fistula catheterization, identification of tracheomalacia, and bronchographic mapping of bronchiectasis. The youngest patient evaluated for FBA was 1 day of age with talcum powder aspiration and the oldest was 16 years (median age 3.9 years); 13.3% were 0–6 months, 15.3% 6–12 months, 53.8% 1–5 years, and 17.4% more than 5 years old. The male-to-female ratio was 287/307.

The patients who had been evaluated for FBA were divided into two major groups according to the history. Group 1 consisted of 438 patients who had a definitive history of FBA. Group 2 comprised 156 patients presenting with chronic or recurrent pulmonary symptoms without a history of FBA. All the patients in group 2 had been treated in the pediatric department, but had not responded to medical therapy, and bronchoscopy was performed to exclude the presence of an underlying FBA. All patients had plain chest radiographs (CXR) prior to bronchoscopy except 8 in group 1 who needed urgent intervention.

Bronchoscopy was carried out in the operating room with the patient under general anesthesia. Pediatric rigid bronchoscopes were used. CXRs were repeated shortly after the procedure and the

majority of patients were discharged on the same or the following day.

Results

In group 1, the usual presenting symptoms were sudden onset of coughing, choking, wheezing, and/or respiratory distress after FBA. Of the 438 patients, 203 (46.3%) presented on the 1st day, 118 (27%) on the 2nd to 7th day, and 117 (26.7%) had a history exceeding 8 days after FBA. The shortest interval to presentation was 20 min and the longest 5 years. The long intervals were due to underestimation of the history of FBA by the physicians. The most common presenting sign in group 2 was pneumonia. Among the patients with proven FBA in group 2, 3 had been treated for bronchiectasis and the other 2 for asthma for years.

Emphysema of one lung or lobe due to air-trapping was the most common radiographic finding in group 1 (61.1%), followed by an opaque FB and atelectasis (15.2% and 13.1%, respectively). In patients with proven FBA, 17% had normal CXRs (Table 1). In group 2, 70% of the patients had consolidation on CXR and 3.2% of those who had recurrent pulmonary symptoms such as asthma or bronchiolitis had normal CXRs between the attacks.

Different types of FB were found in the tracheobronchial tree in 403 patients, and all but 4 were removed successfully. The FB was in the right main bronchus in 176 patients (43.6%), the left main bronchus in 139 (33.7%), the trachea in 46 (11.4%), and bilateral in 15 (3.7%). The remaining 27 (6.6%) were located in the distal bronchi (Table 2). The most common FBs removed were peanuts or hazelnuts (120 patients) and sunflower seeds (116). In 39 patients, a variety of pins and in 11 pen caps or plastic materials were identified (Table 3).

A FB was identified in 83% of patients in group 1 (365/438). All except a pen cap and three pins that were located very distally were removed. Due to failure of rigid and flexible bronchoscopy, these 4 patients required a thoracotomy for removal of the FB. Three patients coughed out the pins before the bronchoscopic investigation. Despite a history of FBA, no FB was identified at bronchoscopy in 71 (17%) patients in group 1.

Table 1 Radiographic findings in patients with foreign-body (*FB*) aspiration (no. of patients and percent)

	Group 1 (%)	Group 2 (%)
Air trapping	268 (61.1)	29 (18.5)
Atelectasis	60 (13.6)	28 (17.9)
Opaque FB	67 (15.2)	1 (0.6)
Normal	73 (17)	5 (3.2)
Pneumonia	27 (6.1)	108 (69.2)
Pneumothorax	7 (3)	1 (0.6)
Bronchiectasis	–	4 (2.5)

Table 2 Location of foreign bodies

	n (403)	%
Right main bronchus	176	43.6
Left main bronchus	139	33.7
Trachea	46	11.4
Bilateral	15	3.7
Distal bronchi	27	6.6

Table 3 Foreign bodies removed during bronchoscopy

	n (403)	%	Mean age (years)
Peanuts or hazelnuts	120	30	2.7
Sunflower seeds	116	29	2.5
Pins	39	9.6	12.7
Watermelon seeds	29	7	3
Plastic materials/pen caps	11	1.7	8
Talcum powder	7	1.7	1.5
Others	81	21	4.2

Although there was no definite history of FBA, FBs were identified and removed in 38 (25%) patients in group 2. In 6 a mucous plug causing airway obstruction was identified and bronchoscopic aspiration was curative. The patients who had recurrent bronchiolitis or asthma before bronchoscopy continued treatment of the underlying disease after excluding a FB. In the remainder, bronchoscopy did not give more information and the aspirated material was cultured.

The complication rate was 9.8% in group 1. Six patients developed severe bronchospasm and 2 had profound bleeding from granulation tissue during the procedure. Following bronchoscopy, 23 (5.2%) patients had pneumonia, 7 had atelectasis, 3 had vocal-cord edema, and 2 developed a pneumothorax requiring intercostal drainage. There was no mortality in group 1. The complication rate was 17.3% in group 2. In 1 patient who had atelectasis of the left lung for 5 years, bilateral tension pneumothoraces developed during extraction of the FB. An emergency thoracotomy and left pneumonectomy was carried out. In 22 patients (in 5 of whom FBs were extracted), atelectasis and severe bronchospasm developed after bronchoscopy. The patients who had severe bronchospasm (n = 10) were admitted to the intensive care unit; 2 needed a tracheostomy and died 1 and 4 months after tracheostomy, respectively, due to chronic lung disease.

Discussion

Bronchoscopy is performed for both therapeutic and diagnostic purposes in the care of children. A history of possible FBA, tracheoesophageal fistula or tracheomalacia, and atelectasis are some of the indications [7]. In our series, most of the bronchoscopies were performed for removal of a FB from the tracheobronchial tree.

A suggestive history of FBA prompts bronchoscopic evaluation and endoscopic removal as the main treatment modality [1, 4]. Although the importance of radiographic findings of a FB has been emphasized, Joseph et al. reported normal findings in 47% of patients with FBA [5, 6, 8]. In our series, a considerable number of patients (17%) with FBA in group 1 had normal radiographic findings, supporting the premise that children with a strong history of FBA should undergo prompt bronchoscopy regardless of the radiographic findings [2, 3, 8].

In our series, bronchoscopies were done based on a definitive history in 73% of patients and FBs were removed in 83%. Therefore, although symptoms such as coughing, wheezing, and CXRs demonstrating air entrapment, atelectasis, and an opaque FB confirm the diagnosis, a history of FBA should still be the most important indication for bronchoscopy.

The most commonly aspirated FBs were nuts and seeds in toddlers and plastic materials and pen caps in school-age children. A variety of pins were removed; religious-scarf pin aspiration is unique to pubertal girls in this country in relation to the initiation of Muslim religious practice around the age of 12 to 13 years. The type of FB may also lead to technical difficulties: pins tend to migrate very distally, and pen caps and plastic materials can be difficult to grasp. A thoracotomy was performed in 4 patients due to the above-mentioned limitations.

In the second group with chronic pulmonary disease not responding to medical treatment, all possible etiologic factors other than FBA had been excluded. A FB was identified and removed in 38 of the 156 patients (25%). Children with recurrent pulmonary infections or atelectasis due to a long-standing FB had the disadvantage of inflammation and fibrosis inhibiting its identification and extraction. Because of destruction by a long-standing FB, these patients are also at risk for developing a pneumothorax and bronchial rupture. Patients with chronic disease also carry a higher risk of bronchospasm and atelectasis, necessitating intensive care.

In conclusion, patients with a definitive history of FBA, even with a normal physical examination and radiographic findings, must undergo bronchoscopic investigation. In cases with chronic pulmonary disease resistant to medical treatment, unrecognized FBA must also be kept in mind. These patients are at high risk, and care should be taken in determining the indication and timing of bronchoscopy in order to prevent life-threatening complications.

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