

Foreign Body Aspiration in Children

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Abstract

Study objectives: The young children have a tendency to place objects in their mouths, frequently leading to aspiration of foreign bodies (FBs) into the tracheobronchial tree (TBT). The aim of this study was to present 10 years experience with 202 patients diagnosed and treated for FB aspiration in our clinic.

Design: Retrospective analysis between 1992-2002

Setting: Uludağ University Faculty of Medicine, Department of Pediatric Surgery.

Patients and Methods: 202 patients who were admitted and underwent bronchoscopic examination of the TBT owing to suspected FBs aspiration included in the study. There were 130 male (64%) and 72 female (36%) patients, with a mean age of 2,7 years (range 2 months-13 years). FBs were extracted using an open-tube rigid bronchoscope (Storz, Germany) and suitable coaxial forceps (Storz, Germany).

Key words: asthma, COPD, Foreign body, aspiration, children

Results: Sunflower seeds and hazelnuts were the most common FBs. The distribution of FBs between the right and left lung and trachea was 62, 35 and 3 percent, respectively. The aspirated material was visible on the chest X-ray in only 5 cases. Despite a history of aspiration, bronchoscopy was negative in 15 (7%) of the cases. Tracheostomy (1), thoracotomy and subsequent bronchotomy (2) were performed in 3 of the cases. Cardio respiratory arrest was observed in three (1%) cases.

Conclusion: The patients with FBs aspiration are rapidly recognized from their histories together with a high index of suspicion and easily treated mostly by bronchoscopy or thoracotomy if necessary. Family education is the best preventive measure for decreasing the incidence of this problem.

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Introduction

Foreign bodies in the tracheobronchial tree (TBT) are usually encountered in the pediatric age group. In the United States, foreign body (FB) aspiration is responsible for approximately 2000 deaths a year in children under six years of age (1). Tracheobronchial inhalation of foreign bodies may result in acute respiratory distress, atelectasis, chronic pulmonary infections, abscess, bronchiectasis or asthma (2). In most children the aspiration is manifested by a triad of choking while eating, coughing and wheezing; but the presentation may be more subtle, resulting in prolonged and misguided therapy for asthma and pneumonia prior to correct diagnosis (3). Bronchoscopy is required for treatment. With experience, FB extraction can become a method simple to apply, almost free of complications and uniformly successful (4). We present the results of 10 years experience with 202 patients diagnosed and treated for FB aspiration in our clinic.

Patients and Methods

In the period between January 1992 and March 2002, 202 children were admitted to Uludağ University, Department of

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Age Groups (years)	No of Patients	Percentage
0-1	19	9.4
1-3	77	38.1
4-6	86	42.5
7-9	14	6.9
10-13	6	3.1

Foreign Body	No. of patients
Sunflower seeds	83
Hazelnuts	56
Peanuts	17
Beans	8
Maize	10
Plastic pencil top	8
Metal pins and wires	5
None found	15

Pediatric Surgery for evaluation of FB aspiration. The series consisted of 130 males (64%) and 72 females (36%). Ninety percent of patients were less than six years of age. The age range was 2 months to 13 years (mean 2.7 years) (Table 1). The duration of symptoms from the time of aspiration until bronchoscopy ranged from 1 hour to 8 months.

The most common combination of symptoms was initial choking associated with subsequent cough, wheezing and stridor. Signs of aspiration included fever, cyanosis and chest wall retractions. In patients presenting with a delayed diagnosis following aspiration of organic matter, fever and pneumonia were often evident. The most frequent physical finding was wheezing localized over the lung harboring the offending agent. In one third of the patients, diminished air entry was evident on auscultation of the affected side. Clinical examination was normal in 10 patients.

Most children were initially evaluated by inspiratory/expiratory chest x-ray. If the child was in acute respiratory distress, the procedure was performed on an urgent basis without chest x-ray. Computerized tomography was also used in chronic cases.

The decision to perform bronchoscopy was based on a history suggestive of aspiration, and/or significant auscultatory findings, supported by pertinent radiologic findings.

The bronchoscopies were performed under general anesthesia. An intravenous (IV) route was kept open in order to administer the medications. A rigid pediatric bronchoscopic system with optical telescopes (Storz,

Interval	No. of patients	Percentage	Symptoms
0-48 hours	120	59.4	Coughing, choking, respiratory distress
3-8 days	70	34.6	Respiratory distress, infection
9-30 days	7	3.5	Bronchitis, pneumonia
1-8 months	5	2.5	Chronic bronchitis, bronchiectasis

Germany) was used in all cases. If the procedure was unsuccessful, other techniques, such as tracheostomy, thoracotomy and subsequent bronchotomy, were also used.

In most cases, particularly following the removal of a nutty substance, the TBT was washed with 0.9 percent saline solution and aspirated. During bronchoscopy, prednisolone in a dose of 2 mg/kg was administered intravenously in order to prevent post-bronchoscopy edema.

A routine chest x-ray was taken in all cases following the procedure and the patients were discharged 24 hours following an uneventful recovery.

Results

Foreign bodies were identified and removed in 187 (93%) of the 202 patients, but bronchoscopy was negative in 15 (7%) of the patients. One hundred and twenty cases (59.4%) were admitted within 48 hours of the aspiration, the main symptom being respiratory distress. Seventy patients (34.6%) having mild respiratory distress and signs of pulmonary infection were admitted to the hospital three to eight days following aspiration. Seven patients (3.5%) having bronchitis and pneumonia were admitted to the hospital nine to thirty days following aspiration and 5 patients (2.5%) who had chronic pulmonary infections were admitted one to eight months following FB aspiration (Table 2).

A wide variety of foreign bodies were recovered, but sunflower seeds and hazelnuts were the most common (Table 3). The objects were found in the right bronchus in 62%, in the left in 35% and in the trachea in 3% of the patients. Two thirds of the foreign bodies were in the main stem bronchus on each side and the others in the distal bronchi.

The chest x-ray showed hyperaeration in 130 (64%) and atelectasis in 40 of the cases (19%). The aspirated object was visible in only 5 (2%) of the cases. Radiographic findings were normal in 32 (15%) of the cases.

Bronchoscopy was the first treatment of choice. Coaxial forceps were used successfully for the removal of the object in all but 3 cases (1.5%). The FB was a plastic pencil top in these 3 cases. In one case, the FB was removed by

tracheostomy, using coaxial forceps. In the others, patients in whom the bronchoscopy was complicated by a ruptured bronchus, thoracotomy and subsequent bronchotomy were performed. Bronchoscopy was repeated in 7 (3.5%) cases owing to persistence of the symptoms. Residual foreign bodies were extracted in this second attempt.

Cardiorespiratory arrest occurred in 3 (1%) cases during bronchoscopy, but did not lead to any deaths.

Discussion

Tracheobronchial inhalation of foreign bodies is common in children less than five years of age (5-6). In our series, 90% of patients were less than six years of age. Boys are affected much more frequently than girls because they are more active than girls during childhood (7).

Most of the children (59%) were admitted to the hospital in the first 48 hours following aspiration. These patients had respiratory distress accompanied by symptoms of bronchial irritation such as severe cough. In these cases, urgent bronchoscopic removal of the FB is necessary in order to relieve the respiratory failure.

Dried beans cause a special type of airway obstruction. Within a few hours, dried beans swell rapidly due to absorption of liquids from bronchial secretions and may cause total blockage (8). For this reason, if there is a history of dried bean aspiration, the bronchoscopy must be performed immediately. Symptoms of respiratory distress may increase significantly three to seven days following aspiration of organic objects such as sunflower seeds, hazelnuts or peanuts, due to persistent pulmonary infection as observed in our study. If an early diagnosis and extraction of these foreign bodies are not accomplished, the patient usually continues with recurrent attacks of wheezing and may develop pneumonitis and bronchiectasis (9).

Radiologic findings may vary from being diagnostic to totally unremarkable (10). Most aspirated foreign bodies are radiolucent. Hyperaeration and/or atelectasis coupled with a history of aspiration, should alert a physician to a retained FB (11). However, even utilizing special techniques such as inspiration-expiration films, bilateral decubitus films and fluoroscopy, the diagnosis can only be confirmed in a limited number of cases by means of chest x-ray, thus repeated radiographic diagnostic efforts are not worthwhile (1). In our series, the pre-bronchoscopic chest x-ray was diagnostic in only 5 (2%) of the cases.

Thus, the most important factor enabling early diagnosis is a positive history of aspiration. Physical findings may suggest the possibility of FB. A positive history, together with suggestive physical findings, constitutes a high index of suspicion and this combination is accepted to be an

indication for bronchoscopy. The incidence of late diagnosis in children with FB is so high that factors such as parental negligence that cause delay in seeking a specialist's advice have to be dwelt upon. However, in our late cases, we did not encounter any complication such as bronchiectasis after removing the FB. Recurrent unexplained pulmonary infection, atelectasis or hemoptysis are other indications for bronchoscopy in chronic cases.

In our study, bronchoscopy was repeated in 7 (3.5%) cases owing to persistent symptoms. Residual foreign bodies were extracted in this second attempt. We thought that the first bronchoscopies were unsuccessful due to inadequate evaluation of the tracheobronchial tree.

Black et al. suggested that when the bronchoscope and FB are removed together, a second look with the bronchoscope must be performed in order to check for a FB fragment, to aspirate the retained secretions for culture, and to evaluate the severity of the bronchitis (2). In all of our patients, the entire TBT was washed out with 0.9 percent saline solution and aspirated after extraction of the FB.

There are sporadic reports on medical treatment of these patients prior to bronchoscopy, consisting of physiotherapy and postural drainage. In a report by Law and Kosloske, the success rate of postural drainage was only 25 percent, while the efficacy of bronchoscopic removal exceeded 90 percent (12). In our series, bronchoscopy was successful (98%) in extracting all endoscopically visualized foreign bodies except three. In these three cases, foreign bodies were plastic pencil tops; requiring tracheostomy in one, and thoracotomy and subsequent bronchotomy in two patients.

Simple removal of the FB may be sufficient to reverse the chronic pulmonary changes so that resection may not be necessary (2,5). Surgical resection should be applied if obvious irreversible changes have occurred. In our series, no patients required pulmonary resection due to delayed presentation. Mu et al. showed that in chronic cases, bronchial edema, pus and granulation tissue may obscure the FB (13). Bronchoscopy may be repeated in such cases if the symptoms persist, as was the case in 7 (3.5%) patients in our series.

Cardiopulmonary arrest may occur before or during bronchoscopic removal in one to two percent of cases (14,15). In our series three instances of cardiac arrests occurred during bronchoscopy (1%).

In conclusion, it is evident that bronchoscopy is the treatment of choice for the removal of all TBT foreign bodies. Preventive measures, however, continue to remain the best means to protect children from foreign body aspiration and family education is the best preventive measure for decreasing the incidence of this problem.

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