

TRACHEOBRONCHIAL FOREIGN BODIES IN INFANTS AND CHILDREN: PRESENTATION AND MANAGEMENT

By
Tarek Eldesoky, MD

From
Mansoura University Children's Hospital
Mansoura Faculty of Medicine

ABSTRACT

Tracheobronchial foreign body aspiration (FBA) is a common event with serious sequences. The aim of this study is to analyze the clinical and radiological spectrum as well as the nature of tracheobronchial foreign bodies (FBs) in children who were positive for foreign body (FB) after bronchoscopy. The age, gender, presence of a history of aspiration, symptoms and signs, radiographic findings, delay in diagnosis, FB type, FB localization in the respiratory tract and number of FBs in each case were noted.

Out of 50 cases, 26 were male and 24 were female. Their age ranged from 5 months to 12 years (mean 2.48 ± 2.23 years). The peak incidence of FBA occurred in the age group 1-3 years. FBA was suspected

by the parents in 70% of patients. Sudden onset of cough (88%), breathlessness (68%) and wheezing (60%) were the predominant symptoms and signs. Atelectasis (42%), normal chest x-ray (24%) and obstructive emphysema (24%) were the most frequent radiological findings. Foreign bodies were localized in the central airway (14%), in the right bronchial tree (40%) and in the left bronchial tree (44%). Bilateral FBs were found in one patient (2%). Watermelon seeds (34%) and peanuts (24%) were the most common FBs aspirated. The mean delay in diagnosis (\pm SD) was 44 ± 114 days. Only 7 patients (14%) were presented in the first 24 hours after aspiration. The longest delay was 2 years.

Conclusion: Tracheobronchial FBs should be suspected in susceptible

patient populations who present with in a suggestive history even with normal physical and radiological findings. Also, in children with unexplained persistent cough, wheezes or pulmonary infiltrates unrecognized FBA should also be considered. Rigid bronchoscopy is necessary for the diagnosis as well as the treatment.

INTRODUCTION

Foreign body aspiration and ingestion in adults and in children have a variety of clinical symptoms and can be unrecognized for some time (1). Many accidental deaths in children are caused by aspiration of foreign bodies into the tracheobronchial tree. In 1986, in the United states , aspirated foreign bodies accounted for 7% of all accidental deaths in children less than 4 years old (2). A delay in the diagnosis of an aspirated FB may increase morbidity and mortality. The accurate diagnosis may elude even the sophisticated physician because often the initial choking episode is not witnessed and the delayed residual symptoms may mimic other common conditions such as asthma, recurrent pneumonia or upper respiratory infection (3). Rigid bronchoscopy is ideal for the extraction of aspirated tracheobronchial FBs, espe-

cially in pediatric patients (4). In this study, the clinical and radiological spectrum as well as the nature of tracheobronchial FBs in children - who were positive for FB after bronchoscopy - were analyzed.

SUBJECTS AND METHODS

This study was carried out on fifty infants and children presented to Mansoura University Children's Hospital. After complete clinical evaluation, all patients with a history of FB inhalation or have a high index of suspicion of FB aspiration underwent rigid bronchoscopy under general anesthesia. The patients who were negative for FB after bronchoscopy or required the removal of mucus plugs were excluded from the study.

The age, gender, presence of a history of aspiration, symptoms and signs, radiographic findings, delay in diagnosis, FB type, FB localization in the respiratory tract and number of FBs in each case were noted. The FB type was identified based on the clinical history and inspection after removal. The period of study was 2 years, 2003 and 2004.

Rigid bronchoscopes (Karl- Storz, Tuttlingen, Germany) with different

sizes (suitable for age) with Hopkins straight forward telescope (Karl-Storz) and optical and ordinary FB extraction forceps were used.

The statistical analysis was performed using the student's t test or χ^2 as needed. The statistical significance was fixed at a p value < 0.05.

RESULTS

A total of 50 patients and 54 procedures were recorded for analysis (the procedure was repeated 4 times in a patient who aspirated meat and 2 times in a patient who aspirated peanut due to incomplete removal). In one patient, a bronchoscopy was done in another hospital and failed to reveal a FB

1-Age and sex :

The most common age group in this study was 1-3 years accounting for 64% of the cases. (table1). The mean age (\pm SD) was 2.48 ± 2.23 years. The youngest patient was 5 months old while the oldest was 12 years. There were 26 males (52%) and 24 females (48%).

2-History of Aspiration : (table2)

A definite history of aspiration was present in 35 cases (70%), how-

ever, a negative history-even on interrogation- was present in 8 cases (16%).

3-Signs and Symptoms

The signs and symptoms associated with FB aspiration are outlined in (table3). The most frequent presenting symptom in this study was cough (88%) followed by breathlessness (68%) and wheezing (60%). Nine patients (18%) presented with cyanosis. The commonest sign was diminished intensity of the breath sounds on the affected side seen in 36 cases (72%), followed by rhonchi (44%) and dullness on percussion (26%).

4-Radiographic findings: (table4)

Chest x-ray was normal in 12 cases (24%) whereas atelectasis was the commonest radiographic finding present in 21 cases (42%), followed by obstructive emphysema then consolidation. No relationship was found between the radiographic finding and the delay in diagnosis or the nature of aspirated FB

5-Location of FB :-

In this series, the distribution of aspirated FBs in the respiratory tract was as follows: 7 FBs (14%) were found in the central airways (larynx

and trachea), 20 FBs (40%) in the right bronchial tree, 22 FBs (44%) in the left bronchial tree. In one patient (2%), 3 FBs were present in both the right and the left sides.

6-Types of aspirated FBs. :

Forty nine of the aspirated FBs (98%) were organic in nature, watermelon seed was the commonest among them (34%), followed by peanut (24%). A list of the various extracted FBs is shown in (table 5).

7-The time taken between aspiration and removal of FBs:

Only seven patients (14%) were presented within 24 hours from aspiration. The longest delay in diagnosis was 2 years present in one patient (2%). The mean delay (\pm SD) was 44 ± 114.2 days.

The mean delay (\pm SD) was sig-

nificantly shorter in patients under the age of one year than the rest of the patients, 10 ± 11.3 vs 53.2 ± 126.7 , respectively ($P = 0.042$). A positive correlation was found between the delay in diagnosis and the age of the patients ($R = 0.58$, $P < 0.001$). No correlation was found between the delay in diagnosis and the type of FB, its location in the respiratory tract or its associated symptoms.

8-Complications :

The most common complication during bronchoscopy was transient hypoxemia (12%) followed by bronchospasm (4%) and stridor due to subglottic edema (2%). All of them were managed effectively. Most of the patients were followed 3 months after the removal of AFBs and no residual symptoms were recorded. No case was lost in this series.

Table (1) Age incidence

Age group (years)	No. of cases (%)
<1	10 (20)
1-3	32 (64)
>3	8 (16)

Table (2) History of aspiration

History	No. of cases (%)
Positive	35 (70)
Negative	8 (16)
On interrogation	7 (14)

Table (3) Symptoms and signs and their relative frequencies

Symptom or sign	No. of cases (%)
Cough	44 (88%)
Breathlessness	34 (68%)
Wheezes	30 (60%)
Stridor	7 (14%)
Fever	10 (20%)
Cyanosis	9 (18%)
Decreased BS* on the affected side	36 (72%)
BB**	4 (8%)
Dullness	13 (26%)

*Breath sound

**Bronchial breathing

Table (4) Radiological findings

Radiological finding	No. of cases (%)
Normal x ray	12 (24)
Atelectasis	21 (42)
Obstructive emphysema	12 (24)
Consolidation	5 (10)

Table (5) Types of extracted foreign bodies

FB type	No. of cases (%)
Watermelon Seed	17 (34.0)
Peanut	12 (24.0)
Orange seed	4 (8.0)
Lupine	3 (6.0)
Carrot	3 (6.0)
Fishbone	3 (6.0)
Chicken bone	2 (4.0)
Sweet peas	2 (4.0)
Meat	1 (2.0)
Corn	1 (2.0)
Pen cap	1 (2.0)
Undetermined	1 (2.0)

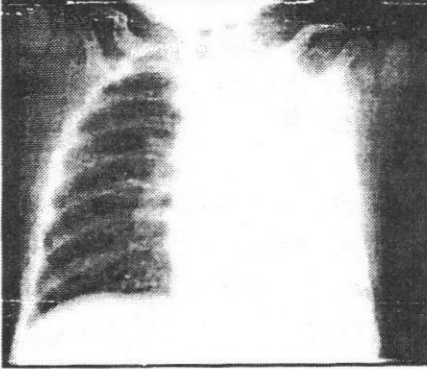


Fig. 1 : Left lung collapse.

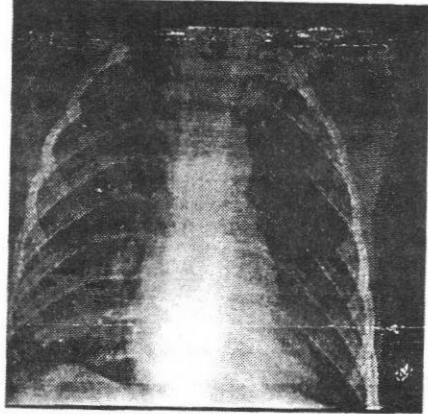


Fig. 2 : Obstructive emphysema of the left lung.

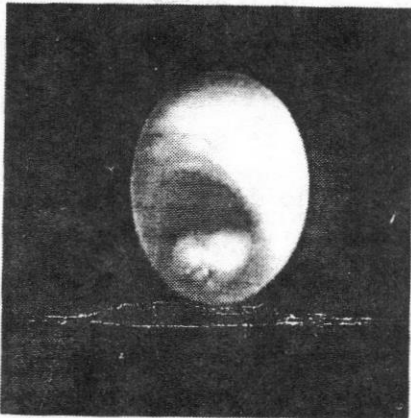


Fig. 3 : A watermelon seed in the trachea



Fig. 4 : A pen tip extracted from the right lower lobe bronchus of an 8 years old child

DISCUSSION

Foreign body aspiration can be a life-threatening emergency requiring immediate interventions. However, symptoms can also go unnoticed for years with serious sequelae. (1,5)

In this study, 64% of the FBs were found in the 1-3 years age group. This finding was reported by other authors (3,6,7,8). This age group is more vulnerable because it lacks adequate dentition (for proper grinding of food) and has immature swallowing coordination (9). Moreover, these children tend to put objects in their mouth more frequently and tend to be running or playing or even talking, laughing or crying at the time of aspiration. Although there was more males than females, no marked sex difference was found, male to female ratio in this study was 1.08:1 (26:24, respectively). Other studies revealed more male predominance; being 1.5:1 (3), 1.4:1(10) and 1.7:1(11). Though there was a positive history of aspiration in most cases (70%), a negative history was found in a considerable percentage (16%). After interrogation, 14% of the care-givers recalled an aspiration episode. Even in the absence of a definite history of aspiration, a very high index of clinical suspicion war-

rants bronchoscopy in order to avoid any delay in the extraction of FB with its subsequent complications. On the other hand, if the history is suggestive of tracheobronchial FB aspiration, even in the presence of a negative physical examination and radiographic imaging, bronchoscopic evaluation is indicated (12).

In children with respiratory symptoms and no history of aspiration, the investigators (13) found that the respiratory symptoms and radiological findings did not differ significantly in those with positive or negative bronchoscopy. With a history suggestive of a FB aspiration but no clinical or radiological findings, the majority of bronchoscopists suggest hospital admission, showing a preference for bronchoscopy with a history of organic FB and observation if inorganic (14).

It is rare to discover serendipitously aspirated FB without any clinical signs (15). In this study, the most frequently reported symptoms and signs were cough, diminished breath sounds on the affected side, breathlessness and wheezing. Thus, the complete triad of coughing, wheezing and absent breath sounds was

present in most cases. This finding has been reported by other studies (6,16). Undiagnosed FB retention can cause local mechanical effects and chemical reactions, and may present *as chronic pulmonary infection, bronchiectasis, apparent asthma, lung collapse or lung abscess* (17). An experimental study (18) concluded that 30-day retention of intra-bronchial peanut caused bronchial cartilage destruction and fibrosis that were attributed as bronchiectatic changes. These children may be treated with antibiotics and steroids, which may further mask the symptoms and lead to further delay in the diagnosis (3).

In general, aspiration of FB produces the following 3 phases: (1) initial phase; choking and gasping, coughing, or airway obstruction at the time of aspiration, (2) Asymptomatic phase; subsequent lodging of the object with relaxation of reflexes that often results in a reduction or cessation of symptoms, lasting hours to weeks. (3) complication phase; FB producing erosion or obstruction leading to pneumonia, atelectasis, or abscess. (19)

The subsequent clinical presentation depends on the location of the

FB, laryngeal FB presents with inspiratory obstruction and hoarseness or aphonia. Tracheal FB presents similarly to laryngeal FB but without hoarseness or aphonia. Also, tracheal FB can demonstrate wheezing similar to asthma. Bronchial FB typically presents with cough, unilateral wheezing and decreased breath sounds (19).

Although fever was found in 10 patients (20%), only 5 of them (10%) had radiological evidence of pneumonia, this fever is an unreliable sign for diagnosis of pneumonia complicating FB aspiration. The same finding was proved also by Farhad et al (15).

In this study, normal chest x-ray was found in 12 cases (24%), most of them (8 cases) had their FBs retained in the trachea. The proportion of normal radiographs in the literature varies from 8% to > 80%, depending on the study and the location of the foreign body (20,21,22,23). Secondary changes on chest x-ray in the form of collapse, obstructive emphysema, and consolidation were found in 38 cases (76%). Similar findings have been reported by other authors (3,7,13). Although most of the foreign bodies are radiolucent, a standard ra-

diological work-up including a postero-anterior and lateral chest film, and a lateral soft tissue neck radiograph should be performed in cases with suspected FBA (24). Initial radiological findings which show unilateral or segmental hyperaeration can become visibly better on either expiratory radiographs or fluoroscopic examination of the lungs (25). Obstructive emphysema, especially when associated with ipsilateral decreased breath sounds, has a very high positive predictive value (26). Additionally, it is important to remember that other pulmonary conditions such as asthma and mucus plugging can mimic the radiographic findings associated with foreign body aspiration (10).

It is usually believed that AFBs are lodged preferentially in the right bronchial tree because of its more vertical disposition (22,27). However, in this study the ratio of FBs in the right and left bronchial trees was 1:1.1. In other studies this ratio was 1.55:1 (3), 1.4:1 (28) and 1.1:1 (15). The preponderant right side location of the FB is not found in children because the left main stem bronchus is closer in size to the right main stem bronchus, in addition, the left main stem bronchus does not branch at the

same acute angle as in adults (26). In one case, we found 3 FBs in both the right and the left sides, so, it is essential during bronchoscopy to explore the entire bronchial tree to search for other FB or fragments lodged contralaterally.

In this series, 98% of the FBs were organic in nature, and consisted mainly of a variety of seeds (table 5), the commonest of them were watermelon seeds (34%) and peanuts (24%). The nature of AFBs differs according to life style and eating habits. The findings in this study agree with those of Mohammed et al (29), Ashour et al (30) and Fadl et al (31) who found that watermelon seeds are the most common foreign body in the middle east, unlike western countries where peanuts are the most commonly encountered foreign body (20,32).

When a FB is inhaled into the distal bronchial system without causing an acute obstruction, it may remain silent for a while depending on its nature. Organic materials cause a more severe inflammation, and granulation tissue may develop in a few hours. Furthermore, objects such as beans, seeds, and corn can absorb water, and with subsequent swelling, partial

obstruction can change to total obstruction. On the other hand, patients who have inhaled small inorganic materials usually remain asymptomatic for a longer period of time unless total obstruction of a distal airway is caused (33)

In the present study, only 14% of the patients reached the hospital within 24 hours of the choking episode. The causes of delay in diagnosis are multiple. The rapid fatigue of the cough reflex after the acute choking episode with subsequent asymptomatic phase creates a false sense of security (3). Also, parental negligence, misdiagnosis and low index of suspicion of some medical personnel lead to the diagnostic delay. The mean delay in this study was significantly shorter in patients under the age of one year than those older than one year ($P=0.04$). The shorter time to diagnosis in infants may be due to more parental alertness and the more central location the aspirated FB in this age. The FBs lodged in the trachea are probably more prone to be symptomatic than FBs lodged in more peripheral airways (15).

CONCLUSION

Foreign body aspiration is a world-

wide health problem which often results in life threatening complications. FBA, although more frequent in the 1-3 age group, can occur at any age. There is a wide range of clinical presentation, however the diagnostic triad of bronchial FB is cough, wheezing and decreased breath sounds on the affected side. The old notion that AFBs are lodged preferentially in the right bronchial tree is true in adults but not in children. Atelectasis and obstructive emphysema are common radiological findings, however, if the history is suggestive, a normal chest radiograph does not rule out a diagnosis of FBA. Rigid bronchoscopy is necessary for the diagnosis as well as the treatment.

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