

# Foreign body inhalation in children: clinical presentations and x-ray chest findings

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## Abstract

**Background:** Foreign body aspiration (FBA) is a medical emergency in children. Delay in diagnosis and treatment can cause complications and even deaths are reported.

**Objective:** The aim of this study was to find out clinical features and x-ray findings in patients with FBA.

**Materials and Methods:** A retrospective analysis was done on all patients less than 15 years of age with the discharge diagnosis of FBA from 2011 to 2014 at SMHS Hospital in Kashmir province.

**Results:** Out of 140 patients with FBA, 87 (62%) were male. The mean age was 48 months. The most common clinical findings were history of choking (77%), decreased breath sounds (42%), wheezing (38%), cough (20%), respiratory distress (15.5%), and fever. CXR was normal in 46% of patients. Air trapping (emphysema) was the most common radiological finding (29.5%) followed by atelectasis (14%) and consolidations (9.2%) and opaque foreign bodies (5.7%). Gram seeds (pulses) were the commonest foreign body (40%). Bronchoscopic removal of foreign body was done successfully in 133 patients (95%).

**Conclusion:** Although FBA in children diagnosed by history, physical examination and radiographic findings, but this finding may be misleading. Negative X-ray chest should not exclude the diagnosis of FBA in children especially with a strong history of FBA. Early bronchoscopic examination will be safe and lifesaving.

**KEY WORDS:** Foreign body aspiration, chest x-ray, children, pulses

## Introduction

Tracheobronchial foreign body (TFB) is considered as a pediatric emergency. Children under the age of five are affected more commonly. Poor chewing ability, less airway protection reflex, adventurous nature, lack of molars for proper mastication, habit of exploring objects with mouth, and eating while crying or playing are probable reasons in children for being prone to foreign body inhalation.<sup>[1]</sup>

Impaction of foreign body (FB) can occur at any point from the laryngeal inlet to the terminal bronchioles. Often, these

FBs get lodged in the right main bronchus. This is due to the fact that right main stem bronchus is in line with the trachea.<sup>[1]</sup>

FBs are reported to be of different kinds and materials. These range from inorganic materials such as needles, nails, whistles, toy parts, and beads/rosary to organic substances such as groundnuts, maize seeds, water melon seeds, beans, variety of grains, and so on. This broad classification becomes important when considering obstruction to airflow, amount of mucosal reaction, inflammation/infection, and abscess formation akin to organic FBs in the tracheobronchial tree. On the other hand, inorganic FBs may cause total or partial obstruction, which may be tolerated for some time with mild signs and symptoms leading to the formation of granulation tissue after an interval of time.<sup>[2]</sup>

The nature/type of FB and the site of arrest or impaction along the tracheobronchial tree decide the clinical course and outcome of inhaled FBs. TFBs can develop complications such as nonresolving pneumonia, hemoptysis, pulmonary atelectasis, bronchiectasis, and even deaths are reported.<sup>[3,4]</sup>

Chest radiography and rigid bronchoscopy are commonly used in the diagnosis of foreign body aspiration (FBA).<sup>[5]</sup>

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computed tomography (CT) is done in some cases. The role of x-ray in diagnosing FB becomes more important in developing countries because all patients cannot afford to get CT done, and CT scan is not available in all centers. Clinicians treating these patients in developing countries should be well aware of the x-ray findings of these patients. FBA typically manifests as obstructive lobar or segmental over inflation or atelectasis in chest x-ray. Although chest x-ray and occasional CT scans are often obtained, final decision for surgical intervention is usually based on a suspicious history and physical examination.

The type and location decides the management of FB inhalation. Rigid bronchoscopy remains the gold standard for removal of these FBs. Tracheotomy is performed on rare occasions.<sup>[6]</sup> Thoracotomy and segmental resection of the lung by cardiovascular thoracic surgeons are procedures rarely done these days.

From January 2011 to January 2014, 140 patients with TFB were treated in our hospital and their medical records were reviewed retrospectively. Aims of this study were to report our experience in terms of signs and symptoms of patients, location of FB, and x-ray findings.

## Materials and Methods

This is a 3-year retrospective review of inpatient (IPD) files of patients who have had bronchoscopies performed for FB inhalation at the Otorhinolaryngology Department of Government Medical College, Srinagar, from January 2011 to January 2014. All the cases were referrals from the accidents and emergency unit, Emergency Pediatric Unit, and direct referrals from peripheral hospitals as well. This hospital is the only tertiary center where rigid bronchoscopy for TFBs is done.

A total of 140 patients' inpatient files were retrieved for the study. All the 140 patients underwent chest x-ray PA view examination and seven of them underwent additional chest CT and three-dimensional reconstruction.

Basic information such as date of birth, age group, gender, indication for bronchoscopy, type of FB, x-ray findings, sites of FB impaction, and surgical outcome were recorded and analyzed. In our center, only the rigid bronchoscopy is carried out for FB inhalation extraction.

Inclusion criteria were as follows: history of FBA, presence of TFB on bronchoscopy, recurrent cough, or dyspnea. Exclusion criteria were as follows: patients with nasopharyngeal, hypopharyngeal, and esophageal FBs; evidence of asthma, and age above 15 years.

Parents'/guardian's informed consent was obtained. Approval of ethical committee was not necessary in this retrospective study.

## Results

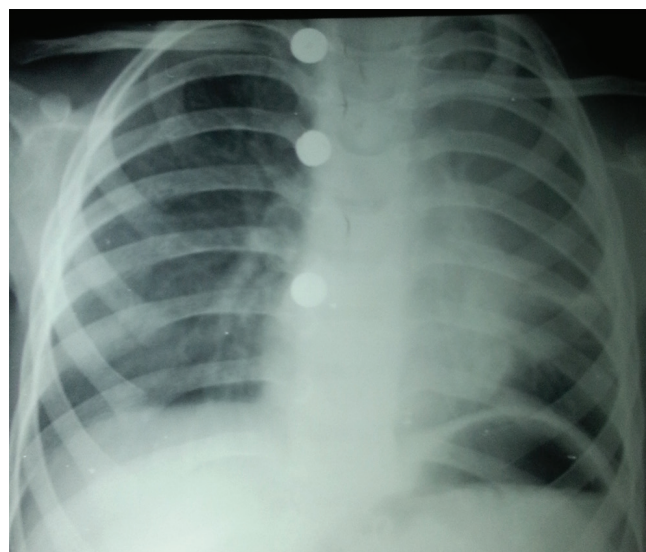
Out of a total of 140 patients, 87 (62%) were males. The mean age of patients was 48 months and the peak incidence

of aspiration occurred during 1–6 years, accounting for 82.2% of the total cases. The signs and symptoms are outlined in Table 1. The most frequent symptom was sudden onset of choking reported by 77% of patients. Forty two percent of the patients presented within 24 h of aspiration. CXR was normal in 46% of patients. Air trapping (emphysema) was the most common radiological finding (29.5%) (Figure 1) followed by atelectasis (14%) and consolidations (9.2%) (Figure 2), and opaque FBs (5.7%) (Figures 3 and 4). Radiographic findings are shown in Table 2. The FB was food material in all except eight cases. Nearly half of the organic aspirated FBs were gram seeds (pulses) followed by peanuts and groundnuts.

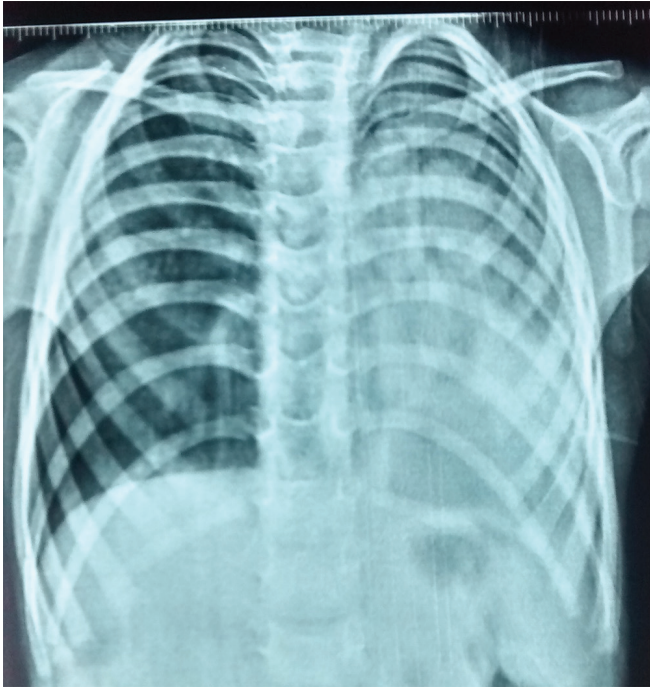
Right main bronchus was the main site of impaction in 38.6%, left main bronchus in 22%, and carina in 23.6% patients. Two patients had FB in both left and right bronchial tree. In 133 patients (95%), the FB had been removed successfully under general anesthesia using rigid bronchoscope. The remaining seven patients had been referred to Cardiovascular Thoracic Surgery as they were too distally located to be removed by rigid bronchoscopy. Flexible bronchoscope was not available in the hospital during that period. Complications were seen in

**Table 1:** Frequency of symptoms and signs in children with FBA

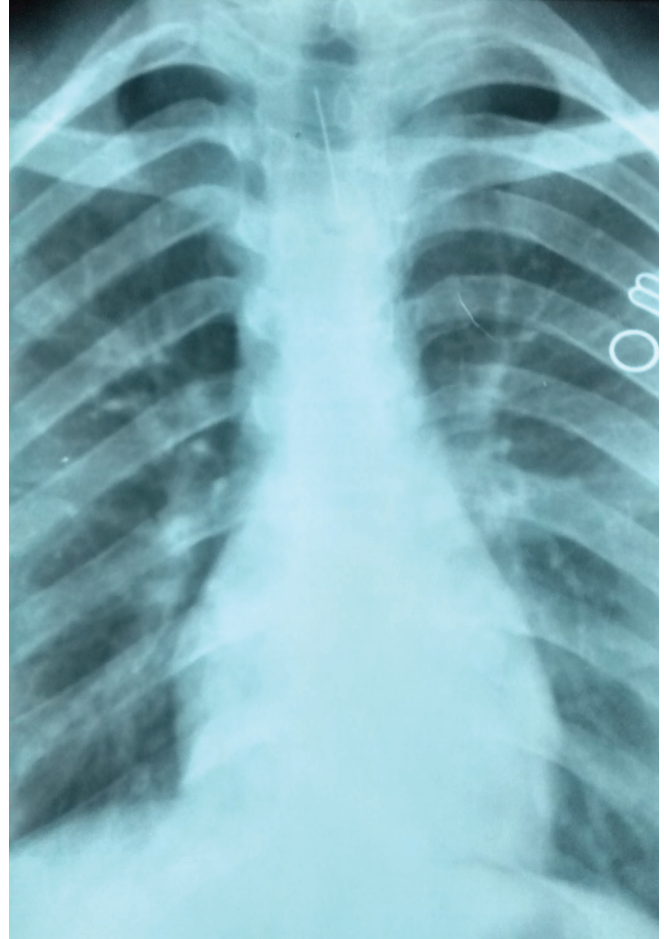
Symptoms and Signs	Present No (%)
Choking	109 (77)
Wheezing	54 (38.6)
Decreased breathing sounds	59 (42)
Cough	98 (20)
Respiratory Distress	7 (15.4)
Fever	7 (15.4)
Pneumonia	6 (4.6)
Stridor	3 (6.6)



**Figure 1:** A chest radiograph of a 5-year-old child demonstrates right lung air trapping.



**Figure 2:** A chest radiograph of a 5-year-old child shows Atelectasis of the left lung.



**Figure 4:** A chest radiograph of a 10-year-old shows hair pin in trachea.



**Figure 3:** A chest radiograph of a 6-year-old shows metallic pen cap in right main bronchus.

5.7% of patients, including cardiac arrest (1), laryngospasm (5), pneumothorax (1), and pneumomediastinum (1). The median hospital stay was 2 days and mortality rate was 1.4%.

**Table 2:** Radiographic findings in patients with FBA

Radiographic finding	No (%)
Visible foreign body	8(5.7)
Air trapping	41(29.5)
Pneumonia	13(9.2)
Atelectasis	14(10)
Normal CXR	64(46)

## Discussion

The mean age of patients in our study was 48 months and the peak incidence of aspiration occurred during 1–6 years of age. One similar retrospective study by Liang et al.<sup>[1]</sup> found 72.5% of patients with TFB were aged between 1 and 3 years.<sup>[1]</sup> The reasons for high incidence of TFB in young children are their absence of molar teeth, insufficient chewing, less developed airway protection reflex, and their high interest in exploring environmental objects with mouth.<sup>[7]</sup>

Out of a total of 140 patients, 87 (62%) were males. A higher male preponderance ratio of at least 2:1 or more has been reported by several authors.<sup>[8]</sup>

Nearly half of the organic aspirated FBs were gram seeds (pulses) followed by peanuts and groundnuts. A recent study in Kenya revealed that the commonest organic FB in their series was beans while the second was peanuts/groundnuts.<sup>[9]</sup> In a study by Ahmed and Shuiabu,<sup>[8]</sup> the commonest organic FB inhaled by children was found to be groundnut.

Children may either present with typical history of aspiration or an atypical history with nonspecific symptoms. Accurate history and a high degree of suspicion are needed to prevent delayed diagnosis and the complications.<sup>[10-13]</sup> The most frequent symptom in our study was sudden onset of choking reported by 77% of patients followed by decreased breath sounds and wheezing. The most common signs and symptoms of FBA are choking, coughing, wheezing, and decreased breathing sounds.<sup>[14,15]</sup> A study by Kaur *et al.*<sup>[16]</sup> similar results were found. Our study and their study found that diagnostic triad of TFBs is seen in most patients. Similar results were obtained in the studies by Banerjee *et al.*<sup>[17]</sup> and Inglis and Wagner.<sup>[18]</sup> These symptoms of TFB may mimic tracheobronchitis, recurrent pneumonia, and asthma. These patients may be treated with antibiotics and steroids, which mask the signs and symptoms and leads to further delay in seeking treatment. In a child of less than 5 years of age with an unexplained cough, wheeze, and decreased air entry, FB should always be excluded.

The main site of FB was right main bronchus in 38.6%, left main bronchus in 22%, and carina in 23.6%. Two of our cases had FB in both bronchi. In a study by Liang *et al.*<sup>[1]</sup> FB was encountered in the right bronchus in 52.1% cases, the left bronchus in 782 cases (39.1%), subglottic larynx in 148 cases (7.4%), and bilateral bronchus in 28 cases (1.4%). With regard to site of impaction or lodgment of FBs, most studies have reported the preferential lodgment of FBs in children and adults in the right main bronchus as compared to the left main bronchus, in contrast to the results of a study by Ahmed and Shuiabu,<sup>[8]</sup> who found a preferential lodgment of FBs in the left bronchus than the right with 22.9% and 17.1%, respectively. This was also the finding of Yeh *et al.*<sup>[19]</sup>

Most TFBs in children are food materials that are radiolucent, so accurate diagnosis of such FBs is not always easy.

Air trapping (emphysema) was the most common radiological findings (29.5%) followed by atelectasis (14%), consolidations (9.2%), and opaque FBs (5.7%). Hyperlucent lung was observed in early stages of FBA, while atelectasis or consolidation indicated a fairly advanced stage. Atelectasis has been reported to be more common in adults.<sup>[20-22]</sup> Unilateral obstructive emphysema is the typical indirect radiological sign of radiolucent objects aspirated.

Radio-opacity of FB is the most definitive and less confused sign of TFB, but unfortunately most of these TFBs are not radio-opaque. As we determined in our study, only 5.7% of FBs were opaque.

Chest x-ray test has a relatively low sensitivity in the identification of TFBs. It has been reported that chest CT scan

shows a greater diagnostic accuracy for TFBs than chest x-ray.<sup>[21]</sup> The proportion of normal radiographs reported in the literature varies from 8% to more than 80%, depending on the study and location of FB.<sup>[21]</sup> The present study reveals high percentage of normal chest x-rays (46%), so if the clinician only relies on the x-ray-chest finding and does not take into consideration strong history, the diagnosis and management can be delayed leading to fatal complications. Fluoroscopy may be helpful in patients if an expiratory film cannot be obtained due to lack of cooperation or negative radiological finding. CT scanning has been helpful in children in whom all other modalities, including surgical exploration, had failed to localize an FB.

Our experience and that of others in literature reveal that convincing history and plain chest radiography are two main criteria for the diagnosis of FBA. Rigid bronchoscopy under general anesthesia is a preferred method for the removal of aspirated FB. Complications of bronchoscopy for FBA are uncommon but occur even in experienced hands. In the present study, bronchoscopic removal of FBs was successful in 133 (95%) patients and the life-threatening complication occurred in 8 (5.7%) patients. There were 2 (1.4%) deaths, both because of inability to retrieve FBs in time from main bronchus after being dislodged from right main bronchi leading to fall in oxygen saturation and subsequent cardiac arrest. The study by Kaur *et al.*<sup>[16]</sup> found complication and mortality rates as 10% and 2%, respectively. In a study by Fernandez *et al.*,<sup>[22]</sup> the complication and mortality rates were 5.7% and 0.9%, respectively.

## Conclusion

Children with FB may either present with classical history of FB inhalation or with atypical misleading history. A good and relevant history is in fact most important in diagnosis. x-Ray chest is mostly normal in these patients. The most common x-ray findings if present are air trapping, atelectasis, and consolidation. Negative radiography and fluoroscopy should not preclude bronchoscopy in patients with a strong history of FBA. Early bronchoscopic examination should be considered in any child when FBA is suspected on the basis of history of choking, gagging, and violet coughing.

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