

## Original Research Article

# Diagnostic and therapeutic role of bronchoscopy in suspected cases of foreign bodies in tracheobronchial tree in pediatric age group

Kirti P. Ambani\*, Amit B. Chavda, Urvish D. Patel, Ajay M. Mulani, Shaili S. Shah

Department of ENT, Gmers Medical College, Himmatnagar, Gujarat, India

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### \*Correspondence:

Dr. Kirti P. Ambani,

E-mail: kritiambani8380@gmail.com,

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## ABSTRACT

**Background:** Aim and objectives were to review the importance and benefits of bronchoscopy in suspected foreign body aspiration in tracheobronchial tree, prompt diagnosis and early management, and correlation between clinical and bronchoscopic findings.

**Methods:** A retrospective study was conducted. Total 50 pediatric patients were enrolled in our study who were giving strong history of foreign body aspiration with sudden respiratory symptoms. Chest X-ray PA view was performed in all the patients. All the bronchoscopy done under general anesthesia.

**Results:** In our study, children between 6 months to 3 years of age are the commonest victims, males are more affected than females. Classic triad of unilateral wheeze, coughing, and ipsilateral reduced air entry-is observed in less than 50% of cases.

**Conclusions:** Bronchoscopy is essential in all cases of bronchial foreign body known or suspected and rigid bronchoscopy has proven over time to be safest and most efficacious to therapy. Although X-ray examination is essential for diagnosis and management, CT thorax with virtual bronchoscopy is advisable before bronchoscopy procedure in suspected cases (if general condition permits), it gives better idea about exact location, nature and type of foreign body.

**Keywords:** Rigid bronchoscopy, Foreign body aspiration, Tracheo-bronchial tree

## INTRODUCTION

A foreign body is an endogenous or exogenous substance, incongruous with the anatomy of the site where it is found. Chevalier Jackson defined a foreign body as “an object or a substance that is foreign to its location”.<sup>1</sup> Foreign body aspiration can affect persons of any age, but the vast majority of these accidents occur in children under the age of five.<sup>1</sup> Foreign bodies in the airway continue to be a diagnostic and therapeutic challenge to practicing otolaryngologists. Despite improvements in public awareness and emergency care, death due to aspiration is a leading cause of death in

children. A high index of suspicion for foreign body aspiration is needed, because a foreign body can mimic other medical conditions, particularly without a witnessed event. Hence there can be a delay in management, that may lead to complications.

When any patient gives a history of a foreign body, investigation is warranted regardless of their age or apparent absence of signs and symptoms. In patients suspected of having aspirated a foreign object, appropriate X-rays should be taken. Radiographs in airway foreign bodies are frequently normal in the first 24 hours after the initial event, but may become abnormal

over time.<sup>1</sup> The treatment of choice is bronchoscopic evaluation. Rigid bronchoscopy has proven over time to be the safest and most efficacious therapy.<sup>2</sup>

## METHODS

### Study design

The present retrospective, observational and interventional study was carried out after approval of an ethical committee at the Department of E.N.T. P.D.U. medical college and civil hospital, Rajkot, from February 2017 to January 2019.

### Study population

The study population i.e sample size was decided according to patients consulted to ENT department with suspected foreign body aspiration or sudden respiratory distress, within the time duration of study period, who fulfilled standard criteria for bronchoscopy entered in software OpenEpi, Version 3, open source calculator—SS Propor

$$\text{Sample size } n = \frac{(DEFF \times Np(1 - p) \div d^2 \div Z^2 - 1}{- \alpha \div 2 \times (N - 1) + p \times (1 - p)}$$

Population size(for finite population correction factor or fpc)(N): 70

Hypothesized % frequency of outcome factor in the population (p): 7.8%±6

Confidence limits as % of 100 (absolute±%)(d): 6%

Design effect (for cluster surveys-DEFF): 1

### Study method

#### Inclusion criteria

Pediatric age group (up to 12 years). Patient giving strong history of foreign body aspiration. Sudden respiratory symptoms.

#### Exclusion criteria

Age above 12 years. Patient having congenital anomaly (laryngeal web, laryngeal stenosis). Patients not willing for study.

A total of 50 patients were studied. A detailed history including the situation in which the foreign body was aspirated, symptoms and clinical features were elicited by a pre-structured questionnaire. A thorough examination of vitals, ear, nose, throat and the respiratory system were done in all cases. Chest x-ray was performed in all the patients with suspected foreign body aspiration and CT thorax with/without virtual bronchoscopy was performed

if found necessary. Diagnostic bronchoscopy was done if X-rays didn't reveal a foreign body in patients with a strong history of foreign body. Appropriate lab tests were done. All the bronchoscopic procedures in children were performed under general anesthesia. The procedure was initiated with patient positioned supine and the neck slightly flexed. The larynx was visualized with the assistance of the laryngoscope; the bronchoscope is introduced under direct visualization, and advanced through the vocal cords. After the bronchoscope advanced past the subglottic region, the anesthetic and ventilation circuits were connected to the bronchoscope. Forceps were introduced through the bronchoscope, grasped and removed depending solely on the tactile sense of the endoscopist (it cannot be visualized after introduction of the forceps through the bronchoscope). After the bronchoscopy, all the children were hospitalized for observation of clinical evolution and for control radiological examinations.



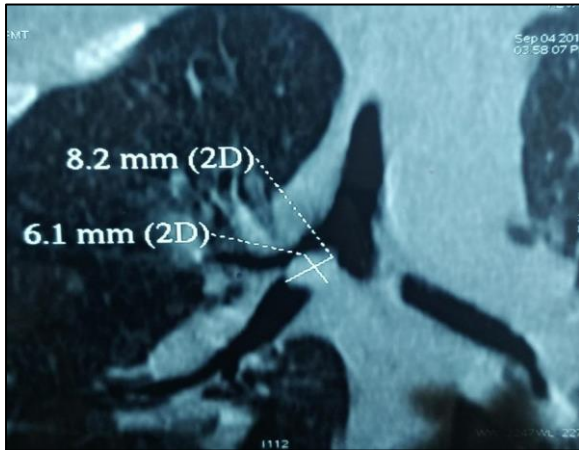
**Figure 1: Right lung collapse - custard apple seed removed from right main bronchus.**



**Figure 2: Hyperinflation of left lung field – Groundnut piece removed from left main bronchus.**

**RESULTS**

We have studied 50 cases of suspected foreign body aspiration that were reported to P.D.U. Medical college and civil hospital Rajkot from February 2017 to January 2019. Patients were given supportive and preliminary medical treatment for a few hours before bronchoscopy if the patient is vitally stable, then bronchoscopy done under general anesthesia.



**Figure 3: Hyperdense foreign body of size 8×6 mm is noted in right main bronchus just below carina.**



**Figure 4: Soft tissue density foreign body within lower trachea adjacent to carina, it approx. measures 3\*6\*12 mm.**

**Age**

*Age incidence as observed in this study*

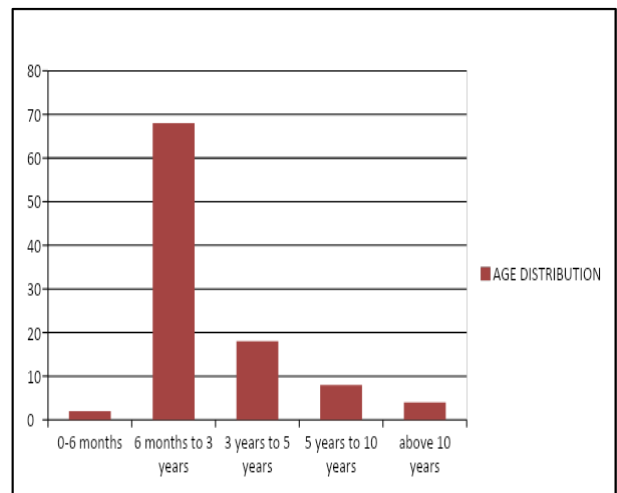
The most common age as observed in this study is between 6 months to 3 years (68%). The youngest of this study being aged 5 months and the oldest being 12 years. According to Chevalier Jackson foreign bodies in the air passage are more common under 3 years of age, because their molars being unerupted, they cannot chew the nuts and are liable to choke on them and to inspire them in the air passages. Our findings are similar to those of

Francois et al who also in their studies found 71% children less than 3 years of age.<sup>3</sup>

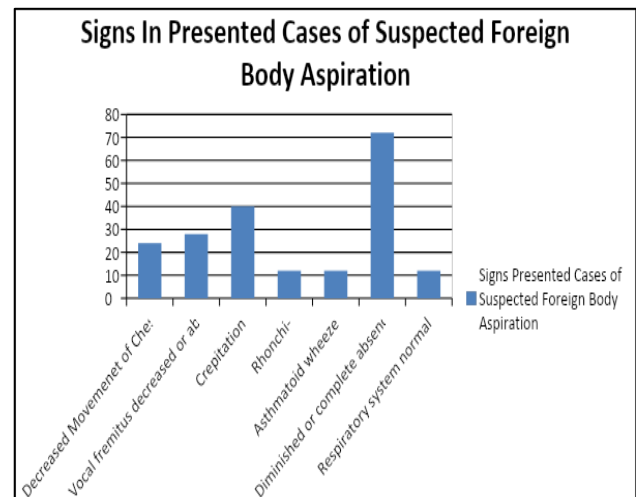
**Signs**

*Signs of foreign body aspiration in patients of this study*

Thus diminished or complete absence of air entry in 72%, crepitation in 40%, vocal fremitus decreased or absent in 28%, and reduced movement of chest wall in 24% were main signs. In 12% of cases the respiratory system was normal, foreign body was found to be into the larynx or trachea.



**Figure 5: Age incidences observed in this study.**



**Figure 6: Signs of foreign body aspiration as observed in this study.**

**Radiological examination**

The radiological study is the most valuable diagnostic aid. It should be done in every case of foreign body present or suspected. It is helpful not only in case with radiopaque foreign bodies, but also in suspected

radiolucent foreign bodies by the changes produced in lung and position of mediastinum. These changes are produced by bronchial obstruction.

In this study 96% foreign bodies are radiolucent and 24% of the chest radiographs inconclusive. So a negative chest radiograph does not rule out foreign body in airway. Wolach et al observed that clinical signs and radiological studies, in most children, were pathognomonic, but sometimes not conclusive.<sup>4</sup> Chest X-rays were normal in 18% cases of their study. In our study obstructive emphysema (44%) was the most common pathological finding in patients with foreign body aspiration.

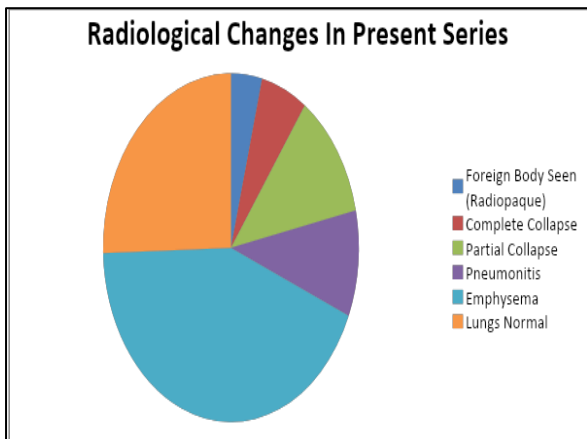


Figure 7: Radiological changes observed in this study.

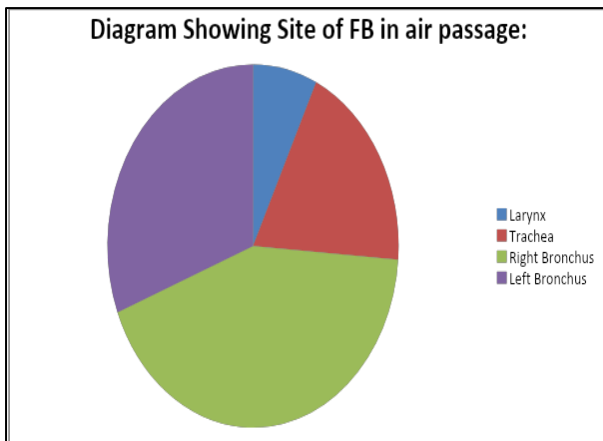


Figure 8: Site of foreign body in airway observed in this study.

**Site of the foreign body lodgement**

My study is too small in comparison to Jackson's study. According to Jackson the right bronchus is more frequently affected than the left. It is clear from Table 13 that right bronchus (43%) is more affected than the left (31%). Our findings are in accordance with Cataneo et al who in their studies of 74 patients suffering foreign body aspiration, reported that the foreign body was lodged in

the right bronchus in 50% of the patients, in the left bronchus in 35% and in the trachea in 15%.<sup>5</sup>

In this study we have performed 50 bronchoscopic procedures in suspected foreign body aspiration patients. Out of 50 cases we have performed 32 diagnostic bronchoscopy on bases of X-ray findings and clinical examination. Out of 32 diagnostic bronchoscopies we have seen foreign bodies in 25 patients and remaining 7 cases had some other pathology in the respiratory system.

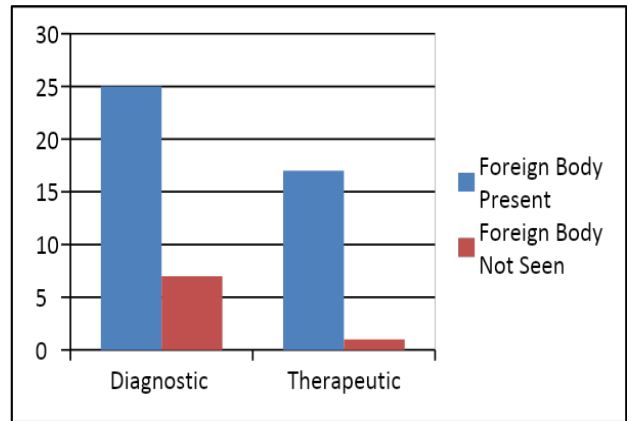


Figure 9: Outcome of diagnostic and therapeutic procedures observed in this study.

We have performed therapeutic bronchoscopy in 18 cases after CT scan Thorax with/without virtual bronchoscopy. We have seen foreign body in 17 cases and there was no foreign body found in one case, in which CT scan report suggested intraluminal soft tissue density area P/O? Foreign body/? Mucous plug.

**DISCUSSION**

Foreign body aspiration is a relatively common occurrence in children. It may present as a life threatening event that necessitates prompt removal of the aspirated material. However, the diagnosis may be delayed when the history is atypical, when parents fail to appreciate the significance of symptoms or when clinical and radiological findings are misleading or overlooked by the physician. Aspiration of organic matter causes severe airway mucosal inflammation. If the organic matter is not promptly removed, chronic inflammation leads to the development of granulation tissue around the foreign body which may ultimately result in lung infection.<sup>6</sup>

A foreign body in the posterior pharynx causes irritation and discomfort that makes the child to cry or cough. Vigorous inspiration causes the foreign body to become impacted within the airway. There is increased resistance to inspiratory and expiratory flow. The impacted foreign body in the thoracic airway creates a valve like effect that causes more airflow obstruction during expiration than during inspiration. This results in generalized or asymmetric air trapping.



Aspiration of foreign body by children can lead to serious illness and sometimes even death. Younger children are at risk for accidental foreign body aspiration due to several factors amongst them including that they: have the tendency to put small objects in to their mouths, often cry, shout, run and play with objects in their mouths, do not have molars to chew certain foods adequately. Boys comprise more than 50% of all cases of foreign body aspiration<sup>7</sup>

Foreign body aspiration remains a huge problem and a major cause of accidental death in children around the world. The age group, 1–5 years, is most vulnerable for foreign body aspiration. Delay in diagnosis can lead to serious pulmonary damage and increased risk of long-term complications. Breathlessness, excessive coughing, and vomiting were considered the main symptoms of foreign body aspiration.<sup>8</sup> Foreign body aspiration is a very serious and most common life threatening problem among pre-school children.

#### **Limitations of study**

Sample size was small due to negative consent from some parents regarding intra-op/post-op complications and post-op ICU admission required.

#### **CONCLUSION**

Children between 6 months to three years of age are the commonest victims and poor socio-economic status is contributory and neglect of children makes them more prone. Vegetative foreign bodies are common, among which groundnuts are being commonest. The classic diagnostic triad of unilateral wheeze, coughing and ipsilateral reduced air entry- is observed in less than 50% of cases so bronchoscopy is essential in all cases of bronchial foreign body known or suspected and rigid bronchoscopy has proven over time to be the safest and most efficacious therapy. Patients representing late for treatment may develop more complications and high chances of mortality. Asepsis, adequate instruments, good anesthetic facilities and experience are essential for safe bronchoscopy. CT thorax with virtual bronchoscopy is advisable before bronchoscopy procedure in suspected

cases (if general condition permits), it gives better idea about exact location, nature and type of foreign body.

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*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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