

# Tracheo-Bronchial Foreign Bodies: A Retrospective Study and Review of Literature

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**Abstract** Tracheobronchial foreign body aspiration is a common emergency in childhood constituting major cause of mortality. Although ample studies regarding airway foreign bodies are present in western literature, studies in Indian context are however lacking. The aim of the study is to present an epidemiological data regarding airway foreign bodies in Indian context thereby helping to analyze the situation with regard to our socio-economic condition. Retrospective file review of all case ( $n = 82$ ) that underwent rigid bronchoscopy for suspected tracheo-bronchial foreign body over a period of 7 years (2001–2008) in the department of otolaryngology of a tertiary care centre of eastern India. Patient characteristics, history, clinical, radiographic and bronchoscopic findings were noted in an attempt to define the epidemiology, clinical presentation, management and associated morbidity. Most common age of presentation was between 1 and 3 years (56.4%). Most common symptom in our study was Cough, wheezing and respiratory distress (63.4%). Most common clinical signs at presentation were diminished breath sound in unilateral lung field seen in 36.6% cases. Most common radiological finding on chest radiograph was collapse seen in 41.65% cases. Most common type of foreign body below 3 years of age was food material (seeds, beans) removed in 48.78%. Complications were encountered in 14.6% cases of which most common complication was bronchospasm and acute respiratory distress seen in 41.6% cases.

**Keywords** Tracheobronchial · Foreign bodies · Airway

## Introduction

Tracheo-bronchial foreign bodies continue to present challenges to otolaryngologists. The major issues involve the accurate diagnosis and speedy, safe retrieval of the foreign body. The accurate diagnosis may elude physicians because often the initial choking incidents are not witnessed and the delayed residual symptoms may mimic other common conditions.

Right from the day of Killian who dared to remove the pork bone with a rigid bronchoscope from 63 year old farmer under local anaesthesia in 1957, we have progressed through the days of Jackson, the father figure of bronchoscopy. The advent of Hopkins telescope guided optical forceps along with anaesthetic progress has made the task of dealing with trachea-bronchial foreign bodies much easier and safer [2].

## Materials and Methods

The study involves the retrospective file review of all case ( $n = 82$ ) that underwent rigid bronchoscopy for suspected tracheo-bronchial foreign body over a period of 7 years (2001–2008) in the department of otolaryngology of a tertiary care centre of eastern India. Patient characteristics, history, clinical, radiographic and bronchoscopic findings were noted in an attempt to define the epidemiology, clinical presentation, management and associated morbidity. Pre-operative Chest X-ray was carried out as routine procedure but CT scan was not done in all due to cost consideration.

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## Result and Analysis

A total of 82 cases were reviewed with the age range of 9 months to 12 years (Table 1). Most common age of presentation was between 1 and 3 years (56.4%) ( $n = 42$ ) with least common age being less than 1 year (6%) ( $n = 5$ ). Males are involved in as many as two-third cases (63.4%) ( $n = 52$ ) (Table 2).

Most common symptom in our study was Cough, wheezing and respiratory distress (63.4%) ( $n = 52$ ) with acute symptoms of Cyanosis with Stridor seen in least number of patients (3.65%) ( $n = 3$ ). Clear presenting symptoms were lacking in as many as 24.4% patients ( $n = 20$ ) and the decision to perform bronchoscopy was based solely on the clinical signs (Table 3).

Most common clinical signs at presentation was diminished breath sound in unilateral lung field seen in 36.6% cases ( $n = 30$ ) followed by unilateral wheeze in 34.13% cases ( $n = 28$ ). Unusual clinical signs of whistling and clicking sounds on auscultation was encountered in 8.53% cases ( $n = 7$ ). No definite signs on examination could be elicited in 20.73% cases ( $n = 17$ ) (Table 4).

Most common radiological finding on chest radiograph was collapse (Fig. 1) seen in 41.65% cases ( $n = 34$ ) followed by normal chest X-ray seen in 24.3% cases ( $n = 20$ ). Emphysema (Figs. 2, 3) was seen in 20.5% cases ( $n = 15$ ). Foreign body could be clearly visualised in only 2.43% cases ( $n = 2$ ) (Fig. 4; Table 5).

**Table 1** Age distribution of patients

Age group	Number of cases; $n$ (%)
Below 1 year	5 (6%)
1–3 years	47 (56.4%)
3–12 years	30 (36.2%)

**Table 2** Sex distribution of patients

Sex distribution	No of patients; $n$ (%)
Male	52 (63.4%)
Female	30 (36.6%)

**Table 3** Presenting symptoms of the patients with airway foreign bodies

Presenting symptoms	No of patients; $n$ (%)
Cyanosis with stridor	3 (3.65%)
Stridor with respiratory distress	7 (8.53%)
Cough, wheezing, occasional respiratory distress	52 (63.4%)
No specific symptoms	20 (24.38%)

**Table 4** Distribution of clinical signs among patients with airway foreign bodies

Clinical signs	No of cases; $n$ (%)
Unilateral wheeze	28 (34.13%)
Diminished breath sound	30 (36.57%)
Whistling and click sound	7 (8.53%)
No definite signs	17 (20.72%)



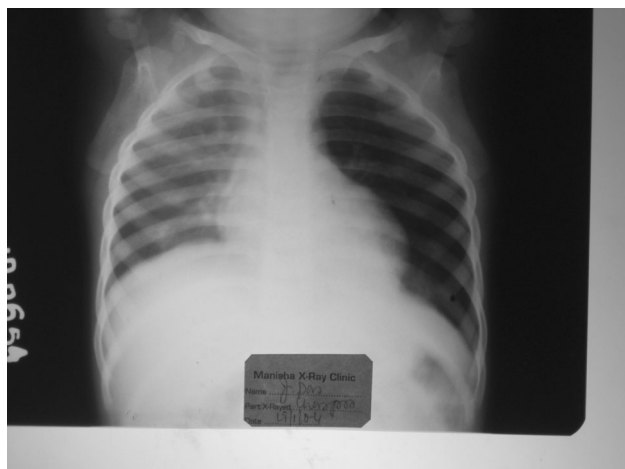
**Fig. 1** Chest radiograph showing collapse of *right* lung



**Fig. 2** Chest radiograph showing obstructive emphysema of *right* lung

Most common type of foreign body below 3 years of age was food material (seeds, beans) removed in 48.78% cases ( $n = 40$ ) whereas the play material such as Whistles and pen caps were most common foreign bodies in age above 3 years ( $n = 24$ , 29.2% cases) (Table 6).

Complications were encountered in 14.6% cases ( $n = 12$ ) of which most common complication was bronchospasm and acute respiratory distress seen in 41.6%



**Fig. 3** Chest radiograph showing obstructive emphysema of *left* lung



**Fig. 4** Chest radiograph showing foreign body in left main bronchus with obstructive emphysema of *left* lung

cases ( $n = 12$ ) followed by intraoperative cardiac arrest in 33.3% cases ( $n = 4$ ). All patients were revived successfully with no mortality. 16.6% cases ( $n = 2$ ) developed pneumothorax requiring water seal chest drains (Table 7).

## Discussion

Right from the day of Killian who dared to remove the pork bone with a rigid bronchoscope from 63 year old farmer under local anaesthesia in 1957, incidence of tracheo-bronchial foreign bodies have changed markedly. The Council of America cited the inhalation of foreign bodies, as a leading cause of accidental death at home, in children younger than 6 years of age [1, 2].

The spectrum of airway foreign bodies varies from country to country, depending on the diet and customs of

**Table 5** Radiographic findings in patients with airway foreign body

Radiological findings	No of cases; $n$ (%)
Obstructive emphysema	15 (20.5%)
Collapse	34 (41.65%)
Normal	20 (24.3%)
Pneumonitis	6 (7.3%)
Consolidation	4 (5%)
Foreign body visualised	2 (2.43%)
Abscess	1 (1.25%)

**Table 6** Types of foreign bodies

Type of foreign body	3–12 years; $n$	Below 3 years; $n$
Food materials (vegetable seeds, bakuldana, sabeda)	6 cases	40 cases
Play materials (whistles, pen cap)	24 cases	12 cases

**Table 7** Complications encountered in patients with airway foreign bodies

Complications	Number of cases; $n$ (%) $N = 12$
Bronchoospasm	5 (41.6%)
Pneumothorax	2 (16.6)
Laryngospasm requiring tracheostomy	1 (8.33%)
Cardiac Arrest	4 (33.3%)

Legends for photograph

population. Although foreign body aspiration can be seen in all ages, it is most common under the age of three [3–5]. Darrow and Holinger reviewed multiple case series and found that children younger than five 5 years of age account for approximately 84% of cases and children younger than 3 years of age account for 73% [6]. A comparable result was seen in our study where the incidence of airway foreign bodies was maximum in the age group of 1–3 years (56.4%). The additional observation of interest was the presence of 6% cases in the age group of less than 1 year. The cause of such finding can be attributed to the habit of children putting all things in mouth, inability to masticate properly, poor swallowing reflex and inattentiveness of the parents. The condition is more common in male patients as compared to females (63.4%) as was noted in other studies [7].

Most common symptom in our study was Cough, wheezing and occasional respiratory distress (63.4%) and not the acute symptoms or penetration syndrome defined as a sudden onset of choking and intractable cough with or without vomiting coinciding with the foreign body

aspiration which was seen in only 3.65% cases as opposed to other studies [8].

Clear presenting symptoms were lacking in as many as 24.4% patients. This may be due to the fact that presentation was significantly delayed in most of our cases due to poor referral protocol. The finding can be explained clinically by rapid fatigue of the cough reflex which can occur within 15 min secondary to desensitization of the cough receptors or due to fatigue of breathing against resistance. So the acute episode can be missed with in a short span of time. Very high index of suspicion is warranted especially in case of children in which acute episode may occur without parents' knowledge and the delayed symptoms indicated other pathology such as asthma, pneumonia, bronchitis.

Most common finding on chest radiograph was collapse seen in 41.65% cases followed by normal chest X-ray seen in 24.3% cases which is in stark contrast to other studies where Emphysema is the most common radiological finding in paediatric age group and atelectasis and collapse is common in adults [8, 9]. This may be due to the fact that the presentation is often very late either due to poor socioeconomic condition and lack of basic pediatric health facilities or due to lack of referral protocols. By this time foreign body often swells up and cause complete obstruction in narrow bronchus of young children. The proportion of normal radiographs reported in the literature varies from 8 to 0.80%, depending on the study and the location of the foreign body [10–13]. Other imaging modalities of significance include computer tomography and magnetic resonance imaging. As a result of its greater contrast resolution, computed tomography scanning useful to demonstrate airway foreign bodies that are radiolucent on plain radiographs. Localization of the foreign bodies within lumen of tracheo-bronchial tree is often possible using 3-D reconstruction [14, 15]. Magnetic resonance imaging has been found to be of special importance in identifying aspirated peanuts. The advantages of MRI include its noninvasive nature and the lack of radiation exposure from this modality. The disadvantages include its cost, the long data-acquisition time, the need for sedation in some patients, and the necessity to remove all metallic devices from patients [16]. Both CT scan and MRI were not used routinely in our study primarily due to the cost factor and time needed for undertaking these investigation which was often critical in patients with tracheobronchial foreign bodies.

Radiolucent bodies can be diagnosed from the secondary pathological changes apparent in the chest films, such as infiltration, unilateral hyperaeration, atelectasis and bronchiectasis. Vane and colleagues reported that more than 90% of foreign bodies were radiolucent. In our study, foreign body can be clearly identified in only 2.43% cases [17].

Most common type of foreign body below 3 years of age was food material (seeds, beans) removed in 48.78% cases whereas the play material such as Whistles and pen caps were most common foreign bodies in age above 3 years. Type of foreign body encountered depends upon the lifestyle and food habit of the population. Nuts in general and peanuts in particular remain the most commonly found aspirated foreign bodies in children in various studies [1, 3, 18, 19].

Type of foreign body encountered also depends upon the socioeconomic condition of the country with organic foreign bodies more common in developing countries. In contrast, more industrialized countries have a greater incidence of plastic foreign body aspiration. This is due to the frequent use of small plastic parts in the toy industry [12, 20, 21].

Regarding management, rigid bronchoscopes are the instruments of choice for foreign body extraction, especially within the pediatric airway. Flexible bronchoscope is often used via the endobronchial tube or laryngeal mask airway enabling foreign body removal but rigid bronchoscopy must be kept on stand by. In our study no such venture for experimentation was undertaken and we carried out all retrievals using rigid ventilating bronchoscope under general anaesthesia. Foreign bodies, which cannot be grasped by endoscopic forceps, can be removed by thoracotomy and pneumotomy. Thoracotomy was required in only case for a marble which could not be removed by conventional bronchoscopy [22].

In managing a patient with tracheo-bronchial foreign bodies the role of an experienced anesthetist can not be underscored as more expertise is needed to maintain airway as compared to its removal in sick patients especially infants and patients with difficult airway secondary to congenital syndromes. Infants and children with trisomy 21, or Down syndrome, can provide challenges in airway management because of their large tongue, relative hypotonia and atlanto-axial instability making mask ventilation difficult and may necessitate the use of a nasal airway and often tracheostomy to provide ventilation and access. A series of congenital syndromes like Pierre-Robin syndrome, Carpenter syndrome, Goldenhar syndrome, Crouzon disease, Freeman-Sheldon syndrome and Treacher-Collins syndrome have as a common feature of mandibular hypoplasia or micrognathia. It is difficult to intubate infants and children with these conditions through direct laryngoscopy and the use of laryngeal mask airway, light wands, or fiberoptic bronchoscopes may be necessary for successful placement of an endotracheal tube. Some patients may even require a surgical airway [23, 24]. Patients with juvenile rheumatoid arthritis present with special challenge in airway management owing to joint stiffness requiring special precaution [25]. Similar precaution along with high index of



suspicion is needed in dealing with patients with mental retardation and psychiatric illness and units providing bronchology services for institutions caring for the mentally-retarded and/or physically-handicapped see more foreign body aspirations and higher incidence of multiple foreign bodies in single patient [26]. Our study encountered no such special case.

Complications during removal of airway foreign bodies via bronchoscopy from the tracheobronchial tree may be encountered even by experienced hands. The most commonly reported complications include failure in removing the FB laryngeal edema, pneumothorax, pneumomediastinum, subcutaneous emphysema, tracheotomy or assisted ventilation necessity for laryngeal obstruction or respiratory distress, hypoxic brain events, bradycardia, cardiopulmonary arrest and even death. Complications were encountered in 14.6% cases in our study, which is slightly higher as compared to other studies, of which most common complication was bronchospasm and acute respiratory distress seen in 41.6% cases followed by intraoperative cardiac arrest in 33.3% cases. All the patients were successfully revived with no mortality [27–29].

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