Tracheo-Bronchial Foreign Body Aspiration in Children: A One Year Descriptive Study

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Abstract The aim of this work was to study the clinical presentation of tracheo-bronchial foreign body aspiration in children for its early diagnosis. This article attempts to address the potential hazards of foreign body inhalation in children and its subsequent management by rigid bronchoscopy. This study was conducted in Department of Otorhinolaryngology, K.L.E.S Dr. Prabhakar Kore Hospital, Belgaum, for a period of 1 year. Children less than 16 years of age with history suggestive or suspicious of foreign body aspiration were screened clinically and radiologically and those patients with high index of suspicion of foreign body were included in the study. All patients were subjected to rigid bronchoscopy under general anaesthesia and the results were analyzed. This study comprises of 29 patients with suspected foreign body aspiration. On rigid bronchoscopy, foreign body was found and successfully removed in 22 patients. Highest incidence was seen in boys between 1 and 2 years age. History of foreign body aspiration was absent in most cases and children presented with combination of symptoms. Obstructive emphysema was commonest chest X-ray finding. There was no significant difference in the site of foreign body aspiration on the right and left bronchus and commonest foreign bodies were vegetative type. Complication rates in this study were low as compared to previous studies. Tracheo-bronchial foreign body aspiration is very

common in children. Foreign body aspiration usually presents as an un-witnessed episode and a high index of suspicion by the surgeon, even in absence of a positive history is necessary to prevent morbidity and mortality due to delayed or misdiagnosis. Foreign body aspiration is an emergency and should be removed by rigid bronchoscopy at the earliest to prevent complications.

Keywords Foreign bodies · Tracheo-bronchial tree · Rigid bronchoscopy

Introduction

The incidence of foreign body aspiration in children has not changed significantly over years and is unlikely to be so as long as young children use their mouths to explore their surroundings as they are orally oriented toddlers [1]. Foreign bodies in airways continue to be a diagnostic and therapeutic challenge for the practicing otolaryngologists [2]. Tracheo-bronchial foreign body aspiration accounts for high incidence, morbidity and mortality in children despite significant advances in prevention, first aid and endoscopic technology [3].

Foreign body aspiration can result in a spectrum of presentations, from minimal symptoms, often unobserved, to respiratory compromise, failure, and even death. The symptoms and signs produced depend upon the nature, size, location and time since lodgement of tracheo-bronchial foreign body [1]. The peak age incidence of airway foreign body aspiration is in between 1 and 3 years but any age can be affected [4].

The type of foreign body inhaled depends upon the nature of environment in which the child finds itself. Vegetative foreign body predominate rural areas, whereas

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pins and coins in urban population [5]. Among vegetative foreign body commonest are fruit and vegetable seeds and nuts [6]. Non organic materials include toys, pen caps, stone, marbles, balloons etc.

In most cases of inhaled foreign bodies, there is definite history of choking followed by paroxysmal coughing which eventually subsides. This is followed by asymptomatic period, which is responsible for delay in diagnosis. The symptom triad of choking, coughing and unilateral wheeze is present in most cases. Acute respiratory distress is fortunately uncommon but most alarming presentation of inhaled foreign body [4]. Long standing airway foreign bodies can result in spectrum of changes ranging from symptoms of cough and wheeze to recurrent or non resolving respiratory sequelae. The symptoms mimic other respiratory conditions like asthma, pneumonia or tracheo-bronchitis [3], which may be wrongly diagnosed and treated. The diagnosis of tracheo-bronchial foreign body requires high index of suspicion by the otolaryngologists, even in absence of a positive history to prevent morbidity and mortality due to delayed or misdiagnosis.

So, any child with history suggestive or suspicious of foreign body aspiration or with clinical or radiographic evidence of tracheo-bronchial foreign body is considered an emergency and should be treated immediately.

Rigid bronchoscopy under general anaesthesia is gold standard treatment of choice for removal of tracheo-bronchial foreign body. Rigid bronchoscopy should be considered the definitive diagnostic and therapeutic intervention in all cases where history and physical examination is suggestive or suspicious of airway foreign body.

Materials and Methods

The present study was conducted in Department of Otorhinolaryngology, K.L.E.S Dr. Prabhakar Kore hospital and Medical Research Centre, Belgaum, for a period of 1 year from November 2004 to October 2005. Children (<16 years) attending ENT and paediatric OPD were included in our study. The inclusion criteria consisted of the following: (i) children younger than 16 years of age with history of foreign body aspiration (ii) children with history of recurrent or non resolving respiratory symptoms with clinical or radiological evidence or suspicion of tracheo-bronchial foreign body even in absence of positive history of foreign body aspiration (iii) history of sudden onset of choking or respiratory distress in an otherwise healthy child. Children with bronchial asthma (as diagnosed by family and past history), acute laryngotracheo-bronchitis, bronchiolitis, bronchiectasis were excluded from our study. All the patients fulfilling the above inclusion criteria were screened clinically, radiologically and

subjected for rigid bronchoscopy under general anaesthesia. Proper written informed consent was taken from all the children's parents or guardian before enrolling them in the study.

Results

The study included a total of 29 patients who had clinical/radiological evidence or a high index of suspicion of foreign body aspiration. All these patients were admitted, investigated and subjected to rigid bronchoscopy under general anaesthesia. Out of 29 patients, 22 patients (75.86%) had foreign body in the tracheo-bronchial tree on bronchoscopy which was subsequently removed and remaining 7 (24.14%) patients did not have any foreign body on bronchoscopy. The patients having foreign body on bronchoscopy have been analyzed further in the results with respect to age incidence, sex distribution, time lag in reaching the hospital, positive history of foreign body aspiration, clinical presentation, radiological findings, type of foreign body and complications and highlighted as follows.

Age Incidence (Fig. 1)

Out of 22 patients with foreign body aspiration, highest incidence was seen in children between 1 and 2 years of age accounting for 10 cases (45.5%), next common age being <1 year in 5 cases (22.7%). The youngest child was of 10 months age and oldest was 11 years of age.

Sex Distribution

Most of patients with foreign body aspiration were males i.e. 18 (81.8%) cases and only 04 (18.2%) were females with male:female ratio 4.5:1.

Fig. 1 Bar diagram showing age incidence of foreign body aspiration

Time Lapse Between Foreign Body Aspiration and Reaching the Hospital

Only 3 (13.6%) patients were brought to the hospital within 24 h of aspiration. Most cases were not emergencies and consulted the hospital between 8 and 15 days and more than a month seen in 5 cases (22.7%) each. The earliest time took by patient to reach the hospital was 4 h while the longest time taken was 6 months (Table 1).

History of Foreign Body Aspiration

14 patients (63.6%) did not give any history of foreign body aspiration and only 8 patients (36.4%) had positive history of foreign body aspiration.

Presenting Symptoms and signs

Patients presented with a combination of symptoms. Most common presenting symptom was coughing and wheezing in 20 (90.9%) cases, followed by breathlessness in 16 (72.7%) cases. History of choking following foreign body aspiration was present in 12 (54.54%) cases and 8 (36.4%) patients gave history of fever.

Most of the patients had diminished or absent breath sounds on the affected side which was seen in 16 cases (72.7%), followed by rhonchi in 12 cases (54.5%) and decreased chest movement during respiration in 11 cases (50%). Dull percussion note and crepitations were present in 10 cases (45.5%) each.

Radiological Findings

Chest X-ray PA view showed obstructive emphysema (Fig. 2) as commonest finding i.e. 12 cases (54.5%) because of more number of vegetative foreign bodies in present study (77.3%). 07 cases (31.82%) showed consolidation/homogenous opacity (Fig. 3). Radio opaque foreign body was made out only in 03 cases (13.6%). 02 Cases (9.1%) had normal chest and neck X-ray finding.

Table 1 Time lapse between foreign body aspiration and reaching the hospital

Duration (days)	No. of cases
<1	03 (13.6%)
1–2	04 (18.2%)
3–7	02 (9.1%)
8–15	05 (22.7%)
16–30	03 (13.6%)
>30	05 (22.7%)

Types of Foreign Body (Fig. 4)

In the present study, vegetative foreign body was commonest type, which was found in 17 cases (77.3%) and remaining 05 cases (27.3%) had non vegetative foreign bodies. Groundnut was commonest vegetative foreign body found in 06 cases (27.3%) and in 04 cases (18.2%) the vegetative foreign was not identified. Non vegetative foreign bodies included pen cap, whistle (plastic), rubber, sketch pen cap, which accounted for 4.5% ($n = 1$) each (Table 2).

Fig. 2 Obstructive emphysema right lung due to inhaled peanut

Fig. 3 Right middle and lower lobe consolidation with opacification in region of right bronchus suggestive of foreign body

Fig. 4 Some foreign bodies removed during this study

Table 2 Table showing the different types of foreign bodies removed during our study

Types of foreign body	No of cases
Vegetative	17 (77.3%)
Groundnut	06 (27.3%)
Tamarind seed	01 (4.5%)
Betelnut/arecanut	02 (9.1%)
Custard apple seed	01 (4.5%)
Water melon seed	01 (4.5%)
Coconut piece	01 (4.5%)
Papaya seed	01 (4.5%)
Unidentified vegetable matter	04 (18.2%)
Non Vegetative	05 (22.7%)
Sketch pen cap	01 (4.5%)
Ball pen rear cap	01 (4.5%)
Plastic whistle	01 (4.5%)
Small rubber piece	01 (4.5%)
Mucous plug	01 (4.5%)

Site of Lodgment of Foreign Body

The most common site of foreign body lodgment was in right main bronchus in 50% cases ($n = 11$), followed by left main bronchus in 45.5% ($n = 10$) and 4.5% ($n = 1$) in trachea.

Complications

Pre-operatively, commonest complication of foreign body aspiration was recurrent pneumonia seen in 7 cases (31.8%), followed by stridor in 04 cases (18.2%) and atelectasis in 03 cases (13.6%). Intra-operative bleeding from

the site of foreign body during removal was encountered in 02 cases (9.1%). In one patient the procedure was abandoned because of bleeding and repeated after 1 week. Post operative bronchospasm was encountered in 02 cases (9.1%). In most patients (81.8%), the intra-operative and post-operative period was uneventful with successful removal of foreign body in all the cases (100%). There were no mortalities in the present study and most of the patients were discharged on the third postoperative day.

Discussion

In the present study the maximum incidence of foreign body aspiration was seen in children less than 2 years of age. This age group is particularly vulnerable because it lacks adequate dentition and has immature swallowing coordination [3]. Additionally these children explore their world by putting objects into their mouth as they are orally oriented toddlers.

Rothmann and Boeckman [7], in their study on 225 patients made a similar observation with 174 cases (77%) of foreign body aspiration occurring in children less than 3 years of age group with maximum incidence in children 1–2 years of age seen in 93 cases (41.33%).

Most of our patients with foreign body aspiration were males with male:female ratio being 4.5:1. McGuirt et al. [8] has also observed male:female ratio of 2:1 stating the reason for this male predominance as more adventurous nature of males.

Many of our patients were treated for weeks at various pediatric services for recurrent respiratory infections before a suspicion of foreign body aspiration arose. Kamaljit Kaur et al. [3] observed 06 (12%) patients reached hospital within 24 h which is similar to our observation, but 30 (60%) of the patients consulted the hospital within 1 week and only 06 (12%) patients after 1 month which was in contrast to our observation. The rapid fatigue of the cough reflex after the acute choking episode due to adaptation of the surface sensory receptors is followed by an asymptomatic phase that tends to create a false sense of security. Parental negligence, misdiagnosis, lack of suspicion or even undue procrastination on the part of fellow professionals contribute significantly to the delay in reaching the hospital [3].

A definitive history of foreign body aspiration was available only in 08 (36.4%) out of 22 cases. Because the children in vulnerable age group (less than 3 years age) are ambulatory and may be out of parental view during the acute aspiration episode, there may not be a witness to supply the incriminating clinical history. The study conducted in 225 cases by Rothmann and Boeckman [7], a definitive history of foreign body aspiration was present in

Table 3 Comparison of signs and symptoms with other studies

Symptoms/signs	Present study	Kamaljit Kaur et al. [3]	McGuirt et al. [8]	Merchant et al. [11]
Cough	20 (90.9%)	46 (92%)	25 (28%)	96 (72.7%)
Breathlessness/resp distress	16 (72.7%)	40 (80%)	–	79 (59.84%)
Wheezing	20 (90.9%)	32 (64%)	25 (28%)	–
Fever	08 (36.4%)	10 (20%)	15 (17%)	41 (31.1%)
Diminished air entry/breath sounds	16 (72.7%)	36 (72%)	41 (47%)	106 (80.3%)
Rhonchi	12 (54.5%)	12 (24%)	08 (9%)	22 (16.67%)
Cyanosis	Nil	–	05 (6%)	11 (8.3%)

Table 4 Site of lodgement of foreign bodies compared with other studies

Site	Present study	McGuirt et al. [8]	Cohen et al. [9]	Kamaljit Kaur et al. [3]
Right main bronchus	11 (50%)	38 (43%)	62 (43%)	28 (56%)
Left main bronchus	10 (45.5%)	21 (24%)	54 (38%)	18 (36%)
Trachea	01 (4.5%)	03 (03%)	27 (19%)	04 (8%)

168 (74.9%) cases, which was in contrast to our observation.

The patients usually presented with a combination of signs and symptoms. The most common presenting symptom was cough and wheezing, followed by breathlessness and the commonest sign was diminished breath sounds on the affected side. The classical diagnostic triad of bronchial foreign body—cough, wheeze and decreased breath sounds was thus seen in most of the cases and has also been reported by other authors Kamaljit Kaur et al. [3], McGuirt et al. [8] (Table 3). Many a times the symptoms may mimic intermittent tracheobronchitis, recurrent pneumonia or asthma and children may be treated with antibiotics and steroids which may further mask the symptoms and lead to delay in diagnosis [3]. Specifically, for this reason, children with atypical or prolonged pulmonary symptoms, the possibility of foreign body aspiration should always be considered.

In this study, vegetative foreign body was commonest, accounting for 77.3% cases. Groundnut being the commonest vegetative foreign body as it is quite cheap and commonly eaten commodity and is given to appease crying children by their ignorant parents realising little its potential of tracheobronchial aspiration.

In our study, there was no significant difference between foreign body aspiration in the right and left bronchus. The likely hood of a foreign body entering the right bronchial tree is more in adults, and there is a more or less equal distribution of foreign bodies between right and left bronchial in children as the difference between the two sides are less pronounced in them [3]. However, Cohen et al. [9], has observed a predominance of foreign

body aspiration in left bronchus in 62 (43%) cases (Table 4).

The commonest complication of foreign body aspiration encountered by us pre-operatively was persistent pneumonia, intra operative bleeding from the site of foreign body and post operative bronchospasm. Emir et al. [10], concluded in their study that cases with chronic pulmonary infection and late presentation are at higher risk of developing complications and care should be taken in deciding the timing of bronchoscopy in this group to avoid life threatening complications. The ventilating rigid bronchoscopy under general anaesthesia remains the gold standard for the safe removal of tracheobronchial foreign body. The rigid ventilating bronchoscope combined with telescopic magnification provides superior visualization and ensures adequate ventilation. Once the foreign body is located and removed it is imperative that the entire airway be re-examined for existence of other simultaneous foreign bodies [8].

Conclusion

- Tracheo-bronchial foreign body aspiration accounts for high incidence, morbidity and mortality in children, the peak incidence occurring in children younger than 3 years of age.
- Foreign body aspiration usually presents as an unwitnessed episode and a high index of suspicion by the surgeon, even in absence of a positive history is necessary to prevent morbidity and mortality due to delayed or misdiagnosis.

- The diagnostic triad of bronchial foreign body i.e., sudden onset cough, wheezing and decreased breath sounds on the affected side is usually present in most of the cases.
 - Conventional X-ray chest usually demonstrate a radio-opaque foreign body, mediastinal shift, obstructive emphysema, collapse or consolidation. However, a negative radiograph does not rule out the diagnosis of foreign body aspiration.
 - Any child with history of foreign body aspiration or with clinical or radiological evidence of tracheo-bronchial foreign body should be considered emergency and treated immediately to prevent morbidity and mortality.
 - Rigid bronchoscopy is the gold standard procedure for diagnosis as well as extraction of tracheo-bronchial foreign bodies and should be performed at the earliest in all the children with clinical or radiological evidence or suspicion of foreign body aspiration to prevent complications.
 - Foreign body aspiration, in children can be prevented by educating the parents and caregivers on appropriate food size and texture as well as acceptable objects for children to play with, under adequate supervision.
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