Original article:

Tracheo-bronchial tree foreign body aspiration among children: A descriptive study

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Abstract:

Introduction: Our aim was to know the demographic and clinical profile of foreign body aspiration in tracheobronchial tree in pediatric age group and to understand the pre and post operative complications of foreign body aspiration in tracheobronchial tree in pediatric age group.

Material & Methods: It was a descriptive study in ENT Department and Pediatrics Department, Krishna Hospital and Medical Research Centre, Karad with sample size 59 Patients with confirmed diagnosis of Foreign body aspiration in Tracheobronchial Tree. Interview and clinical examination with the help of prestructured proforma.

Results: 86.5% children with tracheobronchial tree foreign body aspiration were below 3 years of age and 1.5 times more in males than females. 32.2% of cases were diagnosed within 24 hrs. Cough, Fever and Breathlessness were the commonest presenting symptoms with signs of Respiratory distress, tachypnoea, decreased air entry and rhonchi. In 28.8% of cases, Radiographs were normal. In majority of the cases foreign bodies were on right side. Groundnut and peanut were the commonest foreign bodies. Collapse (33.9%), Empyema (16.9%) and Pneumonia 9 (15.2%) among the pre operative complications. Pneumothorax (16.9%) was the commonest post operative complication. Foreign bodies removed with bronchoscopy in most of the cases with 3.33% mortality.

Conclusion: Children who are left to feed themselves at an early age are more liable for foreign body aspiration. Organic nature of foreign body, site of impaction, lack of history of foreign body aspiration, mis-diagnosis and lower suspicion were the various factors for delayed detection. This can cause significant delay in their removal, thereby increasing morbidity and mortality. The radiography is still a valuable tool in diagnosis of foreign body aspiration. It is mandatory for a child to undergo bronchoscopy when the parents or pediatricians have suspicion of foreign body despite the normal chest radiograph and general well being. The Bronchoscopic procedure should be undertaken as early as possible with adequate preparation as bronchoscopy has become a safer procedure for removal of tracheobronchial foreign body.

Key words: Tracheo bronchial tree, Foreign body aspiration, Bronchoscopy

INTRODUCTION

Problem of Foreign body aspiration, their identification and management have posed a great challenge to medical practitioners. Although serious morbidity and mortality have been decreased significantly over the last three decades, the overall incidence of ingestion and aspiration of Foreign bodies has not been
changed. This will remain a common problem as long as children continue to use their mouth to explore their surrounding. In most cases, a child who has aspirated a foreign body, present as an acute emergency, and can be fatal if they are not removed immediately. Clinical symptoms of foreign body aspiration are variable and depend upon site, duration and type of foreign body aspirated.

Every probable patient of foreign body aspiration was an emergency and its treatment was controversial. But with the advances in technology of endoscopic foreign body removal by Jackson, the availability of safer pediatric anesthesia, improved antibiotics and better radiological imaging, morbidity and mortality have been significantly reduced. Since tracheobronchial tract foreign bodies have always puzzled and mystified, many workers have studied this topic with reference to etiological factors, pathology, complications, and modalities of presentation & treatment with variable results. So the present study was undertaken to study the clinical manifestations, complications and management of foreign body aspiration and also to formulate the guidelines to prevent foreign body aspiration and its complications.

Objectives

1. To know the demographic and clinical profile of foreign body aspiration in tracheobronchial tree in pediatric age group.

2. To understand the pre and post operative complications of foreign body aspiration in tracheobronchial tree in pediatric age group.

MATERIAL AND METHODS

This is a descriptive study carried out in the Pediatric department with the help of ENT and Surgery department in Krishna Hospital and Medical Research Centre, Karad from Jan. 1999 to Dec. 2001. Total 59 Patients with confirmed diagnosis of foreign body aspiration in tracheobronchial tree were included in the study.

Patients presenting with foreign body in the nose, oral cavity and pharynx were excluded from this study.

Interview was conducted of all the patients brought with suspected or clear cut history of foreign body aspiration. In history taking the actual incidence of foreign body aspiration and time of foreign body aspiration was emphasized.

Clinical examination with special emphasis on findings in respiratory system was done. All these patients were investigated by giving importance to radiological findings. In most of the cases complete blood count was done.

With co-relation between clinical examination and radiological findings, diagnosis was done by a team, which included Pediatrician and ENT surgeons. All these patients were subjected to diagnostic and therapeutic bronchoscopy in all the cases, rigid bronchoscopes with appropriate size were used. Each patient was hospitalized till the clinical and radiological recovery. Post bronchoscopy chest radiography was done after 24 hours. All patients were again called for follow-up after 15 days.
Observations

Table 1: Age and gender wise distribution of cases with tracheobronchial tree foreign body aspiration.

<table>
<thead>
<tr>
<th>Age (Months/Years)</th>
<th>n = 59</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-12 mth</td>
<td>14</td>
<td>23.7</td>
</tr>
<tr>
<td>1-2 yr</td>
<td>33</td>
<td>55.9</td>
</tr>
<tr>
<td>2-3 yr</td>
<td>4</td>
<td>6.8</td>
</tr>
<tr>
<td>3-4 yr</td>
<td>5</td>
<td>8.5</td>
</tr>
<tr>
<td>4-5 yr</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5-8 yr</td>
<td>3</td>
<td>5.1</td>
</tr>
<tr>
<td>Above 8 yrs.</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>36</td>
<td>61.1</td>
</tr>
<tr>
<td>Female</td>
<td>23</td>
<td>38.9</td>
</tr>
</tbody>
</table>

86.5% children with tracheobronchial tree foreign body aspiration (51 cases) were below 3 years of age with peak incidence between one to two years. Incidence of tracheobronchial tree foreign body aspiration is 1.5 times more in males than females. Table 1 shows detailed age and gender wise distribution of cases. Out of 59 cases with foreign body in tracheobronchial tree, history of foreign body aspiration revealed in 54 (91.5%) cases.

Table 2: Time interval between foreign body Aspiration or onset of symptoms and diagnosis.

<table>
<thead>
<tr>
<th>Duration</th>
<th>N= 59</th>
<th>percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 24 Hrs</td>
<td>19</td>
<td>32.2</td>
</tr>
<tr>
<td>25 Hrs – 7th Day</td>
<td>27</td>
<td>45.8</td>
</tr>
<tr>
<td>8th day – 15th day</td>
<td>9</td>
<td>15.3</td>
</tr>
<tr>
<td>&gt; 15th day</td>
<td>4</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Table 2 shows that 32.2% of cases with tracheobronchial tree foreign bodies were diagnosed within 24 Hrs of foreign body aspiration and 6.8% of cases had delayed presentation of more than 15 days.

Table 3: Presenting Symptoms among cases of tracheobronchial tree foreign body aspiration.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>No of cases n=59</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough</td>
<td>57</td>
<td>96.6</td>
</tr>
<tr>
<td>Breathlessness</td>
<td>50</td>
<td>84.7</td>
</tr>
<tr>
<td>Fever</td>
<td>33</td>
<td>55.9</td>
</tr>
<tr>
<td>Choking</td>
<td>8</td>
<td>13.6</td>
</tr>
<tr>
<td>Vomiting</td>
<td>8</td>
<td>13.6</td>
</tr>
<tr>
<td>Wheeze</td>
<td>7</td>
<td>11.9</td>
</tr>
<tr>
<td>Cyanosis</td>
<td>5</td>
<td>8.5</td>
</tr>
<tr>
<td>Grunting</td>
<td>4</td>
<td>6.8</td>
</tr>
<tr>
<td>Altered sensorium</td>
<td>4</td>
<td>6.8</td>
</tr>
<tr>
<td>Blood tinged sputum</td>
<td>3</td>
<td>5.1</td>
</tr>
<tr>
<td>Stridor</td>
<td>2</td>
<td>3.4</td>
</tr>
<tr>
<td>Convulsion</td>
<td>2</td>
<td>3.4</td>
</tr>
</tbody>
</table>

# Symptoms are mutually exclusive.

Table 3 shows Cough, Fever and Breathlessness were the commonest symptoms. Most of the patients had more than one symptoms.
Table 4: Presenting Signs of tracheobronchial tree foreign body aspiration.

<table>
<thead>
<tr>
<th>Sign</th>
<th>No of cases n=59</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased air entry</td>
<td>46</td>
<td>77.9</td>
</tr>
<tr>
<td>Respiratory distress</td>
<td>44</td>
<td>74.6</td>
</tr>
<tr>
<td>Tachypnoea</td>
<td>43</td>
<td>72.9</td>
</tr>
<tr>
<td>Rhonchi</td>
<td>41</td>
<td>69.5</td>
</tr>
<tr>
<td>Crepitations</td>
<td>9</td>
<td>15.3</td>
</tr>
<tr>
<td>Altered sensorium</td>
<td>4</td>
<td>6.8</td>
</tr>
<tr>
<td>Convulsions</td>
<td>2</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Respiratory distress, tachypnoea, decreased air entry and rhonchi were the commonest signs, present on physical examination. Unilateral signs were present in 52 (88.1 %) cases, bilateral signs were present in 5 (8.5 %) cases and 2 (3.4 %) case with no signs. Table 4 shows details of presenting signs.

Radiological investigation was done in all cases, revealed Collapse as the commonest radiological feature seen in 19 (32.2 %) cases, Consolidation in 11 (18.6 %), Obstructive empyshema was seen only in 10 (16.9 %) cases and Radio opaque shadow in 2 (3.4 %) cases. In 17 (28.8 %) cases radiograph was normal. Foreign body in tracheobronchial tree were removed in first 24 hours in 54 (93.1 %) cases. One case with foreign body in tracheobronchial tree died before removal of foreign body.

Table 5: Site of foreign body lodgement of Tracheobronchial Tree foreign body.

<table>
<thead>
<tr>
<th>Site</th>
<th>No of cases n = 59</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trachea</td>
<td>4</td>
<td>6.8</td>
</tr>
<tr>
<td>Carina</td>
<td>2</td>
<td>3.4</td>
</tr>
<tr>
<td>Right main Bronchus</td>
<td>23</td>
<td>38.9</td>
</tr>
<tr>
<td>Left main Bronchus</td>
<td>20</td>
<td>33.9</td>
</tr>
<tr>
<td>Right lower lobe Bronchi</td>
<td>8</td>
<td>13.6</td>
</tr>
<tr>
<td>Right and left main Bronchus</td>
<td>2</td>
<td>3.4</td>
</tr>
</tbody>
</table>

The ratio of right sided to left sided foreign body was found to be 1.61 : 1. Table 5 shows various sites of foreign bodies lodgment. Ground nut was the commonest foreign body seen in 29 (49.1 %) of cases followed by pea-nut 11 (18.6%) and gram 6 (10.2%). Coconut piece, tamarind seed, bean seed, rice piece, sugarcane chip and plastic piece of whistle was found in remaining cases. Organic foreign body was found in 96.66% cases and inorganic foreign body in 3.33% cases.

Collapse was the commonest pre operative complication observed in 20 (33.9%) cases followed by empyshema10 (16.9 %) and pneumonia 9 (15.2 %). Cardiac arrest occurred in 4 cases (6.8 %) during bronchoscopic procedure. Among post operative complication pneumothorax was the commonest 10 (16.9%) cases. More than one post operative complications were present in 4 cases. Bilateral pneumothorax occurred in one case. Death
occurred in 2 cases, one was pre operative and other was post operative.

Out of 58 cases 14 (24.1%) cases were discharged within two days of admission, 31 (53.4%) cases discharged between third to seventh day of admission, and 13 (22.4%) cases required longer hospital stay of more than eight days. Foreign body was removed by rigid bronchoscope in 58 cases and 1 case expired before removal of foreign body. Repeat bronchoscopy was required in 5 cases, Tracheostomy was done in 2 cases. One case died after Bronchoscopy. Antibiotics and steroids were given to all patients post-operatively to reduce the post-operative complications like infection and laryngeal oedema respectively.

**DISCUSSION**

1) Age distribution:
Out of 59 cases with foreign body in tracheobronchial tree 51 (86.5 %) cases were below 3 years of age group. Fedl et al.\(^3\) reported that 83.33% cases with foreign bodies in tracheobronchial tree were below 2 years of age group. Following may be the reasons for high incidence of foreign body aspiration below 2 years of age group:

i) Tendency to put anything in to oral cavity

ii) Inadequate control over deglutition.

iii) Tendency to have frequent, vigorous uninhibited inspirations when started, laughing or crying leading to increased chances of foreign body aspiration.\(^4,5\)

Only 2 cases of tracheobronchial tree were above 5 years of age group. Similar observations were found by Fedl et al.\(^3\) in his study.

2) Gender Distribution
Male to female ratio in tracheobronchial foreign bodies was found to be 1.56:1. Similar observations found by Fedl et al.\(^3\), Baharloo et al.\(^6\) and Lakhkar et al.\(^7\).

The aggressive and inquisitive nature of males, might attributed for male predominance in foreign body aspiration.

3) History of Foreign Body Aspiration –
History of foreign body aspiration was revealed in 54 (91.5 %) cases. Even after detailed history, history of foreign body aspiration could not be elicited in 6 (10.2 %) cases.

Similar observations were found by Bhavana B Lakhkar\(^7\), F. D. Fedl \(^3\) and Beg et al.\(^8\) in their studies.

4) Time Interval between Foreign Body Aspiration / Onset of Symptoms and Diagnosis:-
19 (32.2 %) cases out of 59 were diagnosed within 24 hours and 46 (78 %) cases within one week of foreign body aspiration. Similarly, Lakhkar et al.\(^7\) in his study of 97 cases, found that 46 % cases were diagnosed within 24 hours and 87% cases within one week of foreign body aspiration. Similar observations were found in the study of Singh et al.\(^9\).

5) Presenting Symptoms
Cough 57 (96.6%), breathlessness 50 (84.7 %) and fever 33 (55.9 %) were the commonest symptoms observed. Choking episode was present in 8 (13.6 %) cases and wheezing in 7 (11.9 %) cases. Other symptoms were vomiting 8 (13.6 %), cyanosis 5 (8.5 %), convulsions, grunting, blood tinged sputum and stridor in few cases.

Lakhkar, et al.\(^7\) found 79.4 % cases had cough, 53.6% cases had breathlessness and 51% cases had choking episode. Fever was present in 13.5% cases. Beg et al.\(^8\) found cough, breathlessness and wheeze were the common symptoms of presentation.

The high incidence of fever and low incidence of choking may be due to :-
i) Majority of patients were admitted to this hospital after 24 hours of foreign body aspiration, so the chances of developing infection were increased.

ii) All the foreign bodies except one were organic in nature like, groundnut, peanut that has passed through larynx in mainstem bronchi causing chemical pneumonitis with secondary infection.

iii) The continuous unavailability of caretaker might have missed the incidence of choking episode.

6) Presenting Signs :-
Decreased/absent air entry was the commonest sign in 46 (77.9 %) cases followed by Respiratory distress and Tachypnoea in 44 (74.6 %) and 43 (72.9 %) cases respectively. Rhonchi were present in 41 (69.5 %) cases and Crepitations in 9 (15.3 %) cases. Unilateral signs were present in 52 (88.1 %) cases, bilateral signs were present in 58.5 % cases and 2 (3.4 %) case with no signs.
In 4 (6.8 %) cases altered sensorium was observed and 2 (3.4 %) case presented with convulsion.
Singh et al (1995)\(^9\) found 75% cases had reduced air entry and wheeze and respiratory distress was present in 60% and 25% cases respectively.
In this study 17 (56.6%) cases presented with pulmonary infection. Similarly, Lakhakar et al \(^7\) found 50.4% cases with pulmonary infection.

7) Radiological Findings:
Radiological findings suggestive of foreign body aspiration were present in 42 (71.2 %) cases and 17 (28.8 %) cases had normal radiograph. Collapse was the commonest radiological finding found in 19 (32.2 %) cases, followed by obstructive emphysema with mediastinal shift and consolidation in 10 (16.9 %) cases each and radio-opaque shadow was visible in 2(3.4 %) case.
Barton et al\(^10\) reported, Emphysema in 38% cases, collapse in 25% cases, radio-opaque shadow in 12% cases, consolidation in 5% cases and normal radiograph in 19% cases. Similarly in the study conducted by Baharloo et al \(^6\) found, Emphysema in 60% cases, collapse in 13% cases, radio-opaque shadow in 4% cases and normal radiograph in 12% cases.

In this study collapse was the commonest radiological finding, whereas obstructive emphysema in the other studies. The probable reasons for this difference are.

a) All the foreign bodies except one were organic in nature
b) 67.8 % of the patients presented late to the hospital, i.e. after 24 hours of foreign body aspiration.

Organic foreign bodies like groundnut, peanut, absorb fluid and swell over a period of time leading to more complete obstruction and collapse of the corresponding lung segment.

8) Time Interval between Admission and Removal of Foreign body.
Foreign body was removed in 8 (13.8 %) cases within 6 hours of admission, and in 46 (79.3 %) cases between 7 to 24 hours of admission. In 4 (6.9 %) cases foreign body was removed after 24 hours of admission. Death occurred in 1 case before removal of foreign body.
Inglis et al\(^11\) found an average delay of 9 hours between admission and bronchoscopic removal of foreign body.

Dr. Hollinger stated in 1961, “If two hours are spent in preoperative preparations, the safe removal takes only two minutes, but if only two minutes are taken for preparation the endoscopist may find himself attempting make shifts, ineffective procedure for next two hours.” \(^2\)
9) Site of Foreign Body Lodgment
Right main bronchus was the commonest site for foreign body lodgment found in 23 (38.9%) cases, followed by left main bronchus in 20 (33.9%) cases. The ratio of right sided to left sided foreign body was found to be 1.61:1.

Lakhkar et al. in his study found foreign body in the right bronchus in 44.8% cases followed by foreign body in the left bronchus in 40.6% cases with a right sided to left sided ratio of 1.12:1. Similar results were observed in the study conducted by Hughes et al. and Beg et al. 

The reasons for more common lodgment of foreign body in right main bronchus are:
1. Its greater diameter.
2. Its lesser angle of deviation from tracheal axis.
3. Situation of carina, to the left of midline of trachea. 

10) Type of foreign body
Groundnut was the commonest foreign body found in 29 (49.1%) cases followed by peanut and gram in 11 (18.6%) and 6 (10.2%) cases respectively. Coconut piece, tamarind seed, bean seed, rice piece, sugarcane chip and plastic piece of whistle were found in few cases. 96.6% cases were having organic foreign body with 3.3% inorganic foreign body. Beg et al. found organic foreign body in 75% cases and groundnut was the commonest vegetable foreign body in 25% cases.

Similarly Mishra et al. observed groundnut was the commonest foreign body in his study. Lakhkar et al. reported peanut (44.44%) as the commonest vegetable foreign body.

The difference in the nature of foreign bodies reflects the pattern of eating habits in different countries and also in different regions of same country. Groundnuts, peanuts are more common in India, whereas watermelon and pumpkin seeds were common in Greece and Israel respectively.

The nature of foreign bodies also decides the clinical course after aspiration. The inorganic foreign bodies may remain asymptomatic for longer time causing delayed diagnosis, whereas organic foreign bodies which are smaller enough to enter main bronchi or distally, cause chemical pneumonitis.

11) Complications:
Pre-operative complications were seen in the form of collapse in 20 (33.9%) cases, pneumonia and obstructive emphysema in 10 (16.9%) cases. Cardiac arrest was observed in 2 (6.66%) cases during procedure. In this study, pneumothorax was the commonest post-operative complication in 10 (16.9%) cases, followed by collapse and surgical emphysema in 4 (6.8%) and 3 (5.1%) cases respectively. Hypoxic encephalopathy and hydropneumothorax were observed in 2 (3.4%) cases each. In this study 2 patients died, one was preoperative due to obstruction of trachea by foreign body and another on 3rd post-operative day due to bilateral collapse with pneumothorax.

Lakhkar et al. found that pre-operative complications were more common with vegetable foreign body like obstructive emphysema (31.95%), collapse (20.61%) and pneumonia (11.3%). The post-operative complications like hypoxic encephalopathy (2.06%), laryngeal edema (2.06%) and hydropneumothorax (3.3%).

The probable reasons of pre-operative complications in the present study are:
1. All the foreign bodies except one were organic in nature. Organic foreign bodies like peanut, groundnut contain fatty acids, which cause intense
inflammatory reaction and bronchopneumonia.
2. 70% of cases presented late to the hospital i.e. after 24 hours.
The reasons for post-operative complications in the present study are:
1. Surgical Trauma
2. Prolonged Anaesthesia
3. Laryngeal and Tracheobronchial Oedema leading to airway obstruction and collapse
Hospitalisation Period:
1. Most of the cases had pulmonary infection.
2. Presence of post operative complications.
3. Repeat bronchoscopy required in 5 cases.
4. Tracheostomy done in few cases.
13) Treatment
Foreign body was removed by rigid bronchoscope in 58 cases and 1 case expired before removal of foreign body. Rigid bronchoscopic removal of foreign body from tracheobronchial tree is the treatment of choice. General anestheisia was required in all cases. The foreign body was impinged against the bronchoscope with appropriate forceps and both the instruments were withdrawn together. The bronchoscope was reinserted again to ensure that no foreign body piece was left behind. Still repeat bronchoscopy was required in 5 cases, of which incomplete foreign body was removed in 4 cases and the foreign body was not visible in 1 case due to presence of bronchial secretions and mucosal oedema. Tracheostomy was done in 2 cases; one patient was having severe respiratory distress and was not tolerating bronchoscopy, so tracheostomy was done to remove the foreign body through tracheostomy opening. Another case required All the cases were admitted for bronchoscopic removal of foreign body, 14 (24.1%) cases were discharged within 48 hours, 31 (53.4 %) cases were discharged between 3 to 7 days and 13 (22.4 %) cases required prolonged hospital stay of more than a week. Beg et al reported an average hospital stay of 4-5 days. Hospital stay was prolonged in 15.8% cases where major operations in the form of bronchotomy and pneumonectomy were required.
The probable reasons for prolonged hospital stay are:
ittachostomy for artificial ventilation as this case had developed bilateral pneumothorax following cardiac arrest during procedure.
In the present study, antibiotics and steroids were given to all patients post-operatively to reduce the post-operative complications like infection and laryngeal oedema respectively.
Lakhkar et al removed foreign body by bronchoscopy and 1 patient coughed out the foreign body. In the study of Mishra et al tracheostomy was required in 7.40% cases.
CONCLUSION
• The radiography is still a valuable tool in diagnosis of foreign body aspiration in those cases, with negative history of foreign body aspiration.
• It is mandatory for a child to undergo bronchoscopy when the parents or pediatricians have suspicion of foreign body despite the normal chest radiograph and general well being.
• No foreign body should be left alone with the hope that it will come out spontaneously or endoscopic removal would be done later at leisure, because the foreign body from the respiratory tract is associated with high degree of morbidity and in some patients mortality.

www.ijhbr.com  ISSN: 2319-7072
References


