

## Tracheo- bronchial foreign bodies presentation, diagnosis management at tertiary care center

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### Abstract

**Introduction:** The aim of this work was to study the clinical presentation of tracheo-bronchial foreign body aspiration in children for early diagnosis and prompt treatment. This article attempts to address the potential hazards of foreign body aspiration in children and its subsequent management.

**Materials and Methods:** This is a prospective study of 63 cases in age group of 1 to 8 years that underwent Rigid Bronchoscopy for suspected tracheo-bronchial FB over a period of three years in the ENT Dept. of Venkateshwara Institute of Medical sciences. Cases presented in ENT OPD or referred from emergency/department of paediatrics, with history/suspicion of foreign body aspiration, with sudden breathlessness, sudden onset of cough with or without cyanosis/ pyrexia were included in the study.

**Results:** In our study, mean age of patients presenting with foreign body aspiration is 2.4 years. Males (57.1%) presented with foreign body aspiration more frequently as compared to females (42.9%). In 62% cases, there was definite history of foreign body ingestion observed by parents or relatives. Maximum no. of patients presented with sudden onset of cough 38%, followed by sudden onset difficulty in (17.4%), noisy breathing (14.2%), hoarseness of voice(11.2%), vomiting and retching (11.2%), 7.9% patients presented with drooling of saliva(7.9%). In our study majority of FB in air passage were in left main bronchus

54% followed by right main bronchus 36.5% and 6.3% in carina.

**Conclusion:** Tracheo-bronchial foreign body aspiration is common in children. Foreign body aspiration may present as unwitnessed episode and a high index of suspicion, even in absence of a positive history, it 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 fatal complications.

**Keywords:** Foreign bodies, Rigid bronchoscopy, Tracheo-bronchial tree. .

### Introduction

Tracheobronchial foreign body aspiration (TFBA) is a common clinical emergency, with symptoms including hoarseness, cough and dyspnea, more likely to appear in children and possibly associated with immature teeth and uncoordinated swallowing.<sup>1-4</sup> The anatomical structure of the right main bronchi makes foreign bodies more likely to be incarcerated.<sup>5,6</sup> Right bronchus is straighter and broader than the left bronchus, facilitating the deposit of foreign body on right side.<sup>7,8</sup> Patients with mild symptoms may delay hospital visits for longer periods of time, leading to more severe complications.

The most commonly inhaled foreign bodies include food, coins, dentures, metallic objects, plant

seed, animal bone, mineral, and chemical compounds. Generally, free fatty acids of plant seed cause substantial irritation to the airway, leading to mucosal congestion, swelling and secretion, making the surgical procedure more intricate.<sup>9,10</sup> The symptomatic 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.<sup>11,12</sup> Long standing airway foreign body can result in spectrum of symptoms ranging from cough and wheeze to recurrent or non-resolving respiratory sequelae. The symptoms mimic other respiratory conditions like asthma, pneumonia or tracheobronchitis.<sup>13</sup> The diagnosis of tracheo-bronchial foreign body requires high index of suspicion. Even in

absence of a positive history early therapeutic intervention is required to prevent morbidity and mortality due to delayed or missed diagnosis.

Diagnosis of such airway foreign body (FB) is facilitated by a new imaging modality –Virtual bronchoscopy. Virtual bronchoscopy (VB) is software based, three-dimensional visualization formats created from noninvasive medical imaging methods such as CT & magnetic resonance imaging, with the goal of creating views similar to minimally invasive bronchoscopy procedure. This technique offers a detailed view of the airways, with reduced risk of infection or perforation and facilitates preoperative planning for airway interventions that would otherwise not be possible.<sup>14</sup> In presence of a positive clinical diagnosis & inconclusive chest radiography, CT virtual bronchoscopy must be considered to avoid rigid bronchoscopy. Virtual bronchoscopy simulates an endoscopic view of the internal surface of the airway. It gives excellent results regarding location, severity and shape of airway narrowing.

So, any person 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 for tracheobronchial foreign body. Rigid bronchoscopy should be considered the definitive diagnostic and therapeutic intervention in all cases where history and clinical examination is suggestive or suspicious of airway foreign body.

This study was undertaken to determine the proportion of FBs among all paediatric cases seen in the ENT clinic at our hospital, their clinical characteristics and demographic factors associated with this condition.

## Materials and Methods

The study involves 63 cases in age group of 1 to 8 years that presented with suspicion of tracheo-bronchial FB over a period of three years in the ENT department.

## Technique

### Diagnosis

1. Inspiratory and expiratory decubitus films of the chest X-Ray may be helpful in establishing the diagnosis of FBA. More than 50% of patients with early diagnosis (<24 hours) had normal chest Xrays. In Post-24hr period, the common radiographic finding in lower airway aspiration is air trapping. This occurs owing to the Ball valve mechanism, wherein, negative intra-thoracic pressure on inspiration causes dilatation of lumen around foreign body while positive pressure on expiration causes obstruction of lumen and resultant air trapping
2. An early finding on radiographs is a hyper inflated lung contralateral to the obstructed airway. Obstructive emphysema (45%), a contralateral mediastinal shift (35%), atelectasis, consolidation are late findings on radiographs of the affected airway.
3. Computed tomography of the chest may have some additional benefit in acute aspirations, i.e. it can help define radiolucent foreign bodies such as plant seed. CT scan provides useful information (such as the location and size of the foreign object, parenchymal lung changes, and the degree of granulation tissue formation) before attempted extraction.

### Method

1. Bronchoscopy is performed under general anesthesia in the operation theatre, with inhalational induction agent Halothane. Skilled pediatric anesthesia is vital and close cooperation between anesthetist and bronchoscopist is essential to ensure the alveolar ventilation is maintained throughout the procedure.
2. The use of ketamine, a short-acting dissociative anesthetic and analgesic, may be useful in this examination. Although the agent produces a dissociative state, the patient maintains respiratory and airway reflexes, while reducing bronchospasm. The drug is short acting, with an action duration of 15-30 minutes. The dose is 1-2 mg/kg IV. This in combination with Fentanyl (1-2 mg/kg), Glycopyrolate (0.004-0.008mg/kg) and

Midazolam (0.04-0.06mg/kg) gives reliable anaesthesia.

- Rigid bronchoscopy is a valuable tool in tracheobronchial foreign body removal. The optical forceps are integrated with telescope which can be passed through the most rigid ventilating bronchoscopes. Preferred bronchoscope with a rod-lens telescope is Doesel-Huzly bronchoscope (Karl Storz). Age appropriate size of bronchoscope minimizes laryngeal edema.

## Results

A total of 63 cases were reviewed within the age range from 1 to 8yr. The observations pertaining to commonest age of presentation, sexual predominance, most common symptoms and signs of presentation, frequently presenting chest radiograph findings, correlation between history, chest radiography and CT bronchogram findings with the Rigid Bronchoscopy findings, most common foreign bodies removed and their commonest location in the tracheo-bronchial tree are summarized below:-

**Table 1:** Age Incidence

Minimum Age (in yrs)	Maximum age (in yrs)	Mean Age (in yrs)	Std. Deviation
1.00	8.00	2.4120	1.43863

The mean age of patients presenting with foreign body aspiration at our set up is 2.4 yrs.

**Table 2:** Sex Distribution

	Frequency	Percentage
Female	27	42.9
Male	36	57.1
Total	63	100.0

Male child presented with foreign body aspiration in (57.1%), compared to (42.9%) in female child.

**Table 3:** History of FB Inhalation

	Frequency	Percentage
No	24	38.1
Yes	39	61.9
Total	63	100.0

In 62% cases, there was definite history of foreign body ingestion observed by parents or relatives.

**Table 4:** Symptoms Distribution

	Frequency	Percentage
Sudden onset of cough	24	38.1
Sudden onset difficulty in breathing	11	17.4
Noisy breathing	9	14.3
Hoarseness of the voice	7	11.1
Drooling of saliva	5	7.9
Vomiting and retching	7	11.1
Total	63	100

Maximum no. of patients presented with sudden onset of cough 38.1% followed by sudden onset difficulty in breathing (17.4%), noisy breathing (14.3%) Hoarseness of voice (11.1%) vomiting and retching (11.1%), (7.9%) patients presented with drooling of saliva.

**Table 5:** Signs of FB Inhalation

	Frequency	Percent
No Signs	9	14.3
Unilateral reduced Air Entry	27	42.8
Unilateral Wheeze	19	30.2
Whistling and Clicking sounds	8	12.6
Total	63	100.0

42.8 % patients presented with unilateral decreased air entry and 30.2% patients presented with unilateral wheeze.12.6% patients presented had whistling and clicking sounds on auscultation and 14.3% had no obvious signs of foreign body aspiration.

**Table 6:** Chest X-Ray Findings

	Frequency	Percentage
Ipsilateral Collapse	19	30.2
Ipsilateral Emphysema	33	52.4
Normal	11	17.4
Total	63	100.0

52.4% had ipsilateral emphysema on Chest radiogram and 30.2% had ipsilateral lung collapse on chest radiogram. 17.4% patients had normal chest radiograms.

**Table 7: CT Bronchogram Findings**

	Frequency	Percentage
?FB/Mucus Plug	24	38.1
FB	22	34.9
Not Done	17	27
<b>Total</b>	<b>63</b>	<b>100.0</b>

CT Bronchogram of 38.1% patients suggested foreign body/mucus plug while 34.9% patients were reported of having foreign body in their tracheo-bronchial tree. CT Bronchogram was not done for 27% cases as they had obvious history, symptoms or signs of foreign body aspiration.

**Table 8: Rigid Bronchoscopy Findings**

	Frequency	Percentage
<b>2 Foreign Body(FB)</b>	2	3.2
<b>Complicated</b>	2	3.2
<b>Mucopus</b>	9	14.3
<b>Mucus Plug</b>	2	3.2
<b>Non-organic FB</b>	11	17.4
<b>Organic FB</b>	37	58.7
<b>Total</b>	<b>63</b>	<b>100.0</b>

On Rigid Bronchoscopy, organic foreign bodies especially groundnut was removed in 58.7% patients.

**Table 10: Comparison between history and bronchoscopy findings**

		History		Total
		No	Yes	
<b>Bronchoscopy findings</b>	2 Foreign Body	0	2	2
	Complicated	0	2	2
	MUCOPUS	7	2	9
	MUCUS PLUG	1	1	2
	NON-ORGANIC FB	0	11	11
	ORGANIC FB	8	29	37
	<b>Total</b>	<b>16</b>	<b>47</b>	<b>63</b>

P value=0.01 (S)

In 47 cases out of 63, history given by parents/guardians of patients matched with Rigid Bronchoscopy findings. This is proved by using the independent t test (for quantitative data within two groups) level of significance was set at P=0.5.

**Table 11: Comparison between Chest X-Ray and bronchoscopy findings**

		Chest X-ray			Total
		Collapse	Emphysema	Normal	
<b>Bronchoscopy findings</b>	2 FB	0	2	0	2
	Complicated	2	0	0	2

Mucus plug was removed by suctioning in 14.3% patients. Non-organic foreign bodies like pen cap, metal screw and stones were removed in 17.4% of the patients. In one patient(3.2%) there were two stones at the level of left main bronchus and left secondary bronchus.

**Table 9: Location of FB**

	Frequency	Percent
<b>Carina</b>	4	6.3
<b>Left Main and Secondary Bronchus</b>	2	3.1
<b>Left Main Bronchus</b>	34	53.9
<b>Right Main Bronchus</b>	23	36.5
<b>Total</b>	<b>63</b>	<b>100.0</b>

Location of foreign bodies: 54% cases of left main bronchus were removed and 36.5% cases removed from right main bronchus. 6.3% cases were located in carina while in two patients, two foreign bodies were found the level of the left main and secondary bronchus.

	Mucopus	0	2	7	9
	Mucus Plug	0	2	0	2
	Non-organic FB	0	9	2	11
	Organic FB	17	18	2	37
<b>Total</b>		19	33	11	63

P value=0.002 (S)

On comparing the correlation between the Chest radiogram and Rigid Bronchoscopy findings, we found that out of 63 cases, total 40 cases showed relevance between the two and P value is less than 0.5

**Table 12:** Comparison between CT bronchogram and bronchoscopy findings

		CT Bronchogram			Total
		?FB/MUCUS PLUG	FB	X	
<b>Bronchoscopy finding</b>	2 FB	1	1	0	2
	Complicated	0	0	2	2
	Mucopus	8	0	1	9
	Mucus Plug	1	0	1	2
	Non-organic FB	5	3	3	11
	Organic FB	9	18	10	37
<b>Total</b>		24	22	17	63

P value=0.005 (S)

CT Bronchogram was found to be more reliable as compared to Chest Radiogram as it has 100% sensitivity.

## Discussion

FB aspiration in tracheobronchial tree is one of the emergency problems met in otorhinolaryngology practice and the victims are mainly children. The common age group for tracheobronchial foreign body aspiration is between 1 and 8 years with a male predominance. Incidence of FB is less among older children & adults. Our findings are in similarity to those of François M et al who also in their studies found 71% children less than 3 years of age.<sup>15</sup> In study of Hollinger L.D, male to female ratio was 2:1.6.<sup>16</sup>

In our country, a substantial number of babies must be succumbing to this problem before appropriate health care can be arranged. It is important for the treating physician to suspect FB if there is sudden onset of respiratory symptoms or there is history of choking. Ezer SS et al found a positive correlation between presence of wheezing and FB, presence of symptomatic triad of cough, wheezing & diminished breath sound aided in diagnosis of airway FB in 88%.<sup>17</sup>

In our study, sudden onset of cough was the most common symptom (38%). Difficulty in breathing was second most common symptom followed by vomiting and retching and drooling of saliva. Hollinger LD stated that varied symptomatology of tracheobronchial FB depends on its character, size, shape, site of FB age of host & relative area of lung involvement are other factors giving rise to symptoms.<sup>16</sup> Our findings are consistent with those of Amir Kugelmann et al who also in their study stated that choking and acute cough are the most common presenting symptoms of FBA.<sup>18</sup> According to Burton EM et al cough and wheezing were the most common symptoms.<sup>19</sup>

In our study, majority of FB in air passage were in left main bronchus 54% followed by right main bronchus 36.5% & 6.3% in carina. Our findings are in accordance with Cataneo AJ, who in their studies of 74 patients suffering FBA, reported that the foreign body was lodged in the left bronchus in 50% of the patients, in the right bronchus in 35% and in the trachea in 15%.<sup>20</sup>

Chest radiography is the preferred initial investigation in cases of tracheobronchial FB aspiration. So, a negative chest radiograph does not rule out FB in airway. Wolach B et al observed that clinical signs and radiological studies, in most children, were pathognomonic, but sometimes not conclusive.<sup>21</sup> In our study Chest X-ray finding shows that 52.3% cases of Ipsilateral emphysema were most common pathological finding in patients with FB aspiration. However, because diagnosis was not confirmatory by radiograph further evaluation was done by CT bronchogram. In our study, all the tracheobronchial FBs were successfully removed by bronchoscopy under general anaesthesia.

### Conclusion

FB aspiration is an emergency and team help should be sought early. Techniques should be tailored to the clinical context but spontaneous respiration should be maintained wherever possible. Understand the limitations of imaging techniques such as chest radiographs: plastic is radiolucent. Diagnosis depends on high level of suspicion in a child with sudden onset respiratory distress. Children witnessed to choke while having small objects in their mouth and subsequently develop raspy respiration, wheezing, or coughing should undergo prompt bronchoscopy under general anaesthesia, regardless of radiographic findings. In conclusion, the results of bronchoscopy are very satisfying when the child recovers from airway obstruction. This can be achieved by early diagnosis, supervised transportation to a good centre and rigid bronchoscopy by an expert team with back up ICU facility.

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### Conflict of Interest

None.

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