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Original Research Article

CLINICAL PROFILE AND OUTCOME OF AIRWAY FOREIGN BODY IN CHILDREN - A DESCRIPTIVE STUDY

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Abstract

Background: Tracheobronchial foreign body aspiration is a major cause of morbidity and mortality in children under five years of age, with clinical features often mimicking asthma or pneumonia. This study aimed to analyse the clinical profile and outcomes of airway foreign bodies in children, focusing on the types of foreign bodies and their impact on the clinical presentation and prognosis. **Materials and Methods:** This prospective descriptive study included 84 children at the Institute of Child Health, Madras Medical College from April 2019 to November 2020. A detailed history, clinical examination, and systemic examination were performed. Investigations, such as complete blood count, CRP, LFT, CXR, chest HRCT, and ECG, were performed to assess disease severity. **Result:** The most affected age group was 1-2 years (57.1%), with a higher prevalence in males (65.5%). The mean age was 2.4±2.3 years in males and 2.2±1.7 years in females, with no significant differences in age (p=0.79) and weight (p=0.75). Common presentations included aspiration (81%), breathlessness (60.7%), cough (58.3%), and obstructive emphysema in 75% of the children, predominantly in the right lung (66%). Organic foreign bodies, mainly groundnuts (75%), were the most common, with the right main bronchus being the most common site (50%). The mean hospital stay was 6.7 days, and 98.8% had favourable outcomes, with one case of mortality (1.2%). **Conclusion:** The classical triad of cough, wheezing, and decreased air entry, along with chest X-ray hyperinflation in children under three years of age, strongly suggests foreign body aspiration. Prompt rigid bronchoscopy is essential to prevent severe complications.

INTRODUCTION

Tracheobronchial foreign body aspiration (FBA) is an important cause of paediatric morbidity and mortality, particularly in children aged between 6 months and five years. Children aged–0-3 years constitute > 75% of foreign body aspiration cases. Furthermore, foreign body aspiration accounts for 7% of the deaths among children aged 0-3 years. It is a potentially life-threatening event and may cause chronic lung injury if not properly managed. Respiratory failure occurs when near-complete occlusion occurs at the tracheal level. However, the foreign bodies that have managed to proceed to the lower levels of the tracheobronchial tree can cause respiratory tract problems at the distal region when they are occluded because occlusion leads to ventilation failure which creates a favourable environment for infection.[1]

The symptoms and signs can be confused with those of asthma, and radiographic findings can be confused with those of pneumonia. In developing countries, foreign body aspiration is among the major causes of death in infancy and childhood.[2] It reviews the clinical presentation to define the features that could facilitate early diagnosis. A high degree of suspicion from the clinician is required in children < three years. As a consequence of curiosity, children like to put objects in their mouth and this raises the chance of aspiration in young children.[3] Aspiration in children is due to inadequate chewing, the absence of molar teeth and the smaller diameter of their airway, which is prone to obstruction of foreign bodies.[4]

The clinical presentation of foreign body aspiration varies depending on factors such as the type, size, shape, and duration of foreign body aspiration in the airway. Organic foreign bodies, such as nuts, tend to cause more severe inflammatory reactions, whereas

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non-organic items may remain inert but still obstruct the airway.[5] The foreign body's size determines the obstruction level, ranging from the small bronchi to the main bronchus, with the latter being the most commonly affected site. The shape, whether oval, round, or straight, also influences the degree of airway compromise.[6] In many cases, more than half of the patients lack a clear history of aspiration, especially when the event is unnoticed, leading to misdiagnosis as bronchitis, asthma, or recurrent lung infections.[7]

The respiratory symptoms associated with FBA include nonspecific signs, such as coughing, wheezing, fever, dyspnoea, exercise intolerance, hoarseness, cyanosis, and excessive sputum production, particularly in the early stages. Respiratory signs such as tachypnoea, chest retractions, and crackles may indicate obstruction and the onset of respiratory distress or failure.[8] Hypoxemia is a critical finding, and imaging studies such as chest X-rays or CT scans may reveal diffuse infiltrates, obstructive emphysema, atelectasis, or complications such as lung abscess, empyema, bronchiectasis, or pneumothorax in the late stages. All these symptoms and complications may lead to recurrent infections, haemoptysis, bronchial asthma, and lung abscesses. While a large foreign body can cause sudden death by occluding the respiratory tract completely, a small foreign object may also result in death by obstructing the segmental lobe of the lungs leading to infection and hypoxia.[9]

The early diagnosis and management of patients with an inhaled foreign body offer a diagnostic challenge to the physician. When a foreign body is diagnosed and removed in the early period, no complications develop.[10] The majority of FBs are organic, mainly food particles (groundnut, areca nut, Bengal gram, etc.). The management of FBA depends on the site of impaction and the type of foreign body. Laryngeal and subglottic FBA require urgent tracheostomy, whereas FBs in the right or left main bronchus cause fewer airway problems.[11] Migratory foreign bodies should be suspected when a serial X-ray film shows variations in the site of radiological findings, such as obstructive emphysema on the right or left side. Rigid bronchoscopy is the recommended procedure. Flexible bronchoscopy is a better instrument for diagnostic purposes as well as the removal of foreign bodies.[12]

Aim

This study aimed to analyse the clinical profile and outcomes of airway foreign bodies in children, focusing on the types of foreign bodies and their impact on the clinical presentation and prognosis.

MATERIALS AND METHODS

This prospective descriptive study included 84 children at the Institute of Child Health and Hospital for Children, Madras Medical College from April 2019 to November 2020. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion Criteria

Children aged between 1 month and 12 years with suspected or confirmed clinical or laboratory criteria were included.

Exclusion Criteria

Children with foreign bodies in the gastrointestinal tract, ears, nose, or throat were excluded.

Methods: A detailed history, clinical examination, vital signs, and systemic examinations were performed. To assess disease severity, investigations such as complete blood count, absolute eosinophil count, CRP, LFT, CXR, HRCT chest, and ECG were performed as the condition of the child was warranted.

Statistical Analysis: Data are presented as mean, standard deviation, frequency, and percentage. Continuous variables were compared using an independent-sample t-test. Significance was defined as P values less than 0.05 using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Corp., Armonk, NY, USA).

RESULTS

The most affected age group was 1-2 years (57.1%), followed by 2-5 years (27.3%), 5-10 years (7.2%), 6-12 months (4.8%), >10 years (2.4%), and 0-6 months (1.2%). The proportion of male children was higher (65.5%) than that of female children (34.5%). Most patients (82.1%) were referred for admission, whereas 17.9% were admitted directly [Table 1].

The most common clinical presentation was aspiration, observed in 81% of the children, followed by breathlessness (60.7%), cough (58.3%), diminished air entry in the right lung (40.4%), left lung (35.7%), and fever (25%). Stridor was noted in 14.3% of the children, vomiting, intercostal/subcostal retractions, and crepitations in 10.7% each, and wheezing in 9.5%. Lethargy was present in 4.8% of children, whereas syncope, developmental delay, past tuberculosis, and dextrocardia were observed in 1.2% of children. Bilateral diminished air entry was rare (2.4%), and 21% of patients showed no diminished air entry [Table 2].

The mean weight of the patients was 11.8±4.9 kg. The mean duration of cough was 7.6±11.8 days, which was higher than breathlessness (3.7±5.2 days) and fever (5.1±6.7 days). The mean duration of hospital stay was the longest at 6.7±7.5 days, followed by the duration for removal of the foreign body at 6.5±7.5 days [Table 3].

The mean age of male patients was 2.4±2.3 years, slightly higher than that of females at 2.2±1.7 years, with no significant difference (p=0.79). The mean weight of male patients was 11.9±5.6 kg, compared to 11.5±3.4 kg for females, which was not significantly different (p=0.75) [Table 4].

The most common finding was obstructive emphysema, present in 75% of the children, with a

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higher prevalence in the right lung (66%) than in the left lung (33.3%). The majority of children had no collapse (82.2%), with 17.8% experiencing collapse, mainly in the right lung (9.5%) and left lung (7.1%). Hyperinflation was absent in 89.3% of the children, while consolidation was present in only 4.8%, primarily affecting both lungs (2.4%). A radiopaque object was observed in only 2.4% of the children. Foreign bodies were most commonly located in the right main bronchus (50%) and left main bronchus (42.9%). Organic foreign bodies were the most common (95.2%), with groundnuts being the most common (75%). The outcome was favourable, with 98.8% of the children surviving and only one non-survivor (1.2%) [Table 5].

Table 1: Demographic and admission characteristics.

		Frequency (%)
Age categories	0-6 months	1 (1.2%)
	6-12 months	4 (4.8%)
	1-2 years	48 (57.1%)
	2-5 years	23 (27.3%)
	5-10 years	6 (7.2%)
	> 10 years	2 (2.4%)
Gender	Males	55 (65.5%)
	Females	29 (34.5%)
Admission process	Direct	15 (17.9%)
	Referred	69 (82.1%)

Table 2: Clinical presentation and findings

		Frequency (%)
Aspiration	Present	68 (81%)
	Absent	16 (19%)
Breathlessness	Present	51 (60.7%)
	Absent	33 (39.3%)
Cough	Present	49 (58.3%)
	Absent	35 (41.7%)
Lethargy	Present	4 (4.8%)
	Absent	80 (95.2%)
Fever	Present	21 (25%)
	Absent	63 (75%)
Vomiting	Present	9 (10.7%)
	Absent	75 (89.3%)
Syncope	Present	1 (1.2%)
	Absent	83 (98.8%)
Developmental delay	Present	1 (1.2%)
	Absent	83 (98.8%)
Past Tuberculosis	Present	1 (1.2%)
	Absent	83 (98.8%)
Dextrocardia	Present	1 (1.2%)
	Absent	83 (98.8%)
Diminished air entry	Left lung only	30 (35.7%)
	Right lung only	34 (40.4%)
	Bilateral	2 (2.4%)
	None	18 (21%)
Intercostal/Subcostal retraction	Present	9 (10.7%)
	Absent	75 (89.3%)
Crepitations	Present	9 (10.7%)
	Absent	75 (89.3%)
Wheeze	Present	8 (9.5%)
	Absent	76 (90.5%)
Stridor	Present	12 (14.3%)
	Absent	72 (85.7%)

Table 3: Mean clinical parameters and hospital stay

	Mean
Weight (kg)	11.8±4.9
Duration of breathlessness (days)	3.7±5.2
Duration of cough (days)	7.6±11.8
Duration of fever (days)	5.1±6.7
Duration for removal of foreign body (days)	6.5±7.5
Duration of hospital stay (days)	6.7±7.5

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Table 4: Comparison of age and weight between genders

	Mean		P-value
	Male	Female	
Age (in years)	2.4±2.3	2.2±1.7	0.79
Weight (in kg)	11.9±5.6	11.5±3.4	0.75

Table 5: Radiological findings, foreign body characteristics, and outcomes

		Frequency (%)
Obstructive emphysema	Absent	21 (25%)
	Present	63 (75%)
	Left lung only	21 (33.3%)
	Right lung only	42 (66%)
Collapse	Absent	69 (82.2%)
	Present	15 (17.8%)
	Left lung	6 (7.1%)
	Right lung	8 (9.5%)
	Bilateral	1 (1.2%)
Hyperinflation	Absent	75 (89.3%)
	Present	9 (10.7%)
	Left lung only	8 (9.5%)
	Right lung only	1 (1.2%)
	Bilateral	0 (0%)
Consolidation	Absent	80 (95.2%)
	Present	4 (4.8%)
	Left lung only	1 (1.2%)
	Right lung only	1 (1.2%)
	Bilateral	2 (2.4%)
Radio-opaque object	Seen	2 (2.4%)
	Not seen	82 (97.6%)
Location of foreign body	Left main bronchus	36 (42.9%)
	Right main bronchus	42 (50%)
	Trachea	6 (7.2%)
Type of foreign body	Organic	80 (95.2%)
	In-organic	4 (4.8%)
Individual foreign body	Groundnut	63 (75%)
	Chickpea	1 (1.2%)
	Cashew nut	3 (3.6%)
	Toy parts	2 (2.4%)
	Coconut piece	1 (1.2%)
	Rupee coin	1 (1.2%)
	Button battery	2 (2.4%)
	Others (black gram. green chilli, Bengal gram, and other seeds)	11 (13.1%)
Outcome	Survivors	83 (98.8%)
	Non-survivors	1 (1.2%)

DISCUSSION

In our study, paroxysmal cough in 58%, fast breathing in 60%, stridor in 14%, decreased air entry in 79%, wheezing in 10%, fever in 25%, syncope in 1%, and vomiting in 10%. These findings are comparable to those of many studies that reported similar percentages. In Sehgal et al., paroxysmal cough in 57%, fast breathing in 57%, stridor in 50%, decreased air entry in 47%, wheezing in 35%, and fever in 20%.[13] In Puja et al., paroxysmal cough in 71.6%, fast breathing in 47%, stridor in 5.2%, decreased air entry in 64%, wheezing in 30%, and fever in 43%.[14] Parameswaran et al. found paroxysmal cough in 87.5%, fast breathing in 97.5%, stridor in 7.5%, decreased air entry in 87.5%, and wheezing in 27.5%.[15]

Our study had a notably lower incidence of choking, a higher prevalence of stridor, decreased air entry, and a much higher percentage of paroxysmal cough than other studies. Our fast-breathing rate was lower than Parameswaran et al. but higher than Puja et al.[15,14] The prevalence of wheezing was lower in our study compared to the other studies, while fever was less common than in Puja et al.[14]

In our study, obstructive emphysema was observed in 50% of patients, collapse in 18%, consolidation in 5%, radio-opaque foreign bodies (FB) in 2%, and normal radiological findings in 5%. In the study by Puja et al., obstructive emphysema was found in 56%, collapse in 15.7%, consolidation in 10.6%, radiopaque FB in 2.6%, and normal radiological findings in 8%.[14] There was a slight variation in the incidence of radiological abnormalities between the two studies, with a higher rate of consolidation observed in the study by Puja et al,[14] and a slightly higher rate of collapse in our study.

In our study, the position of the foreign body was 8% in the trachea, 50% in the right main bronchus, and 42% in the left main bronchus. The findings were similar to the Sehgal et al. study, where 13% were located in the trachea, 45% in the right main bronchus, and 21% in the left main bronchus.[13] In the Puja et al. study, 2% were in the trachea, 11% in the right main bronchus, and 10% in the left main bronchus.[14] Comparing these findings, our study reported a significantly higher percentage of foreign

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bodies in the right main bronchus and the left main bronchus. Our study had a much lower percentage of foreign bodies in the trachea than other studies.

In our study, 95% of the foreign bodies were organic and 5% were non-organic. In the study by Puja et al., 86.7% were organic and 14% were non-organic,[14] while Parameswaran et al. reported 95.2% organic and 4.8% non-organic foreign bodies.[15] Our findings are consistent with those of Parameswaran et al., who also observed a very high prevalence of organic foreign bodies.[15] However, Puja et al. reported a slightly lower percentage of organic foreign bodies and a higher percentage of inorganic foreign bodies.[14]

In our study, the most commonly aspirated foreign body was the groundnut (67.5%), followed by chickpeas (1.2%), custard apple seeds (2.5%), and toy parts (2.4%). Additionally, coconuts (2.5%), cashew nuts (3.6%), rupee coins (1.2%), and button batteries (2.4%) have also been reported. The "others" category, including black gram, green chilli, Bengal gram, and other seeds, accounted for 13.1%. In Puja et al., groundnut was the most common foreign body (29.5%), followed by chickpeas (23.1%) and custard apple seeds (15.8%). Other foreign bodies such as toy parts (5.3%), coconut (3.2%), and metal balls (2.1%) were less common.[14] In Parameswaran et al., groundnut was the most common (75%), with chickpeas (1.2%) and custard apple seed (3%) reported less frequently. No cashew nut or rupee coin was found in their study.[15]

When comparing the findings, our study showed a significantly higher prevalence of groundnuts (67.5%) than that reported by Puja et al. (29.5%), but lower than those reported by Parameswaran et al.(75%).[14,15] Chickpeas were notably less common in our study (1.2%) than in the study by Puja et al. (23.1%).[14] We also observed foreign bodies such as cashew nuts, rupee coins, button batteries, and a higher proportion of "others" (13.1%) which were not noted in the other studies.

Limitation

This study was conducted at a tertiary care centre in Southern India. Since this was a hospital-based study, there may be a higher prevalence of foreign body aspiration in the general population. Hence, the data cannot be projected onto the general population, for which population-based studies are necessary.

CONCLUSION

The mean age of foreign body aspiration was found to be 2 years amongst (65.5%) of cases were male children. Breathlessness was the most common presentation in 61% of cases, followed by cough in 58.3%, fever in 25%, and diminished air entry in lung fields in 79%. The classical triad of cough, wheezing, and decreased air entry should raise suspicion of airway FB in children presenting with respiratory distress. In addition to this classical triad, hyperinflation of the chest on radiography in children aged < 3 years indicates a strong suspicion of foreign body aspiration. Rigid bronchoscopy should be performed in all children with classical signs and symptoms, even if not witnessed, as the risk of serious complications caused by retained FB outweighs the low morbidity associated with rigid bronchoscopy performed for airway foreign bodies.

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