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Original Research Article

Foreign body aspiration in children

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ABSTRACT

Background: Foreign Body (FB) aspiration is a life-threatening problem in children. Here the demographic pattern, clinical presentation, type of Foreign Body (FB) and outcome of FB aspiration was examined.
Methods: An observational case series study done in Institute of child health and research centre, Government Rajaji hospital, Madurai during November 2015 to June 2018. After a detailed history and clinical examination, children with definite evidence of FB in tracheobronchial tree were subjected to rigid bronchoscopy and with doubtful evidence were subject to FFBS. They were followed up for complications.
Results: Of the 136 children, 86.03% (n=117) were under 3 years of age. A positive history of FB aspiration was present only in 51.4% (n=70). Unilateral hyperinflation was seen in 48.53% (n=66) but was normal in 13.97% (n=19). Flexible Fiber Optic Bronchoscopy (FFBS) diagnosed FBs in 61.02% (n=83) which included children with acute onset breathlessness and persistent radiological features. Peanut was the most common FB 64.71% (n=44). FBs were found in the right side in 50% (n=34) and in the left in 38.2% (n=26). 36% (n=49) developed complications due to the FBs and 2.9% (n=4) due to procedure.
Conclusions: FB aspiration is most common in children less than 3 years of age. Positive history of aspiration was seen in only 51.4% and chest X-ray was normal in 13.97%. FFBS diagnosed FB in 61.02%. Peanut was the most common FB. Persistent pneumonitis is the most common complication.

Keywords: Acute breathlessness, Aspiration, Bronchoscopy, Foreign body, Peanut, Tracheobronchial tree

INTRODUCTION

Foreign Body (FB) aspiration is a life-threatening problem in children. It is one of the common causes of pediatric respiratory emergency. Especially in children whose parents do not give a positive history of FB aspiration, the diagnosis of a FB might be missed and delayed. Undiagnosed, retained FBs may cause serious complications such as pneumonia, collapse consolidation and bronchiectasis. A rigid endoscopy is indicated whenever there is a suggestive history, since delays in removing foreign bodies can lead to severe bronchial sequelae.[1] Still, in cases where confirmed diagnosis of FB aspiration could not be made, decision for rigid bronchoscopy is difficult as it bears some risks.

Aim of this study was to examine the demographic pattern of children with foreign body aspiration in institute of child health and research center, evaluate the clinical presentation, investigations, type of foreign body, complications and outcome with respect to the location of foreign body and develop safety guidelines regarding prevention of aspiration in infants and toddlers.

METHODS

Patients with suspected FB aspiration based on history, clinical examination and radiological evidence in institute of child health and research centre, Madurai between November 2015 and June 2018 were taken up for the study. A detailed history, a thorough clinical examination

and radiological investigations were done in all patients. Patients with definite evidence of FB in the tracheobronchial tree were taken up for rigid bronchoscopy directly. Patients with doubtful evidence were subjected to a diagnostic Flexible Fiber Optic Bronchoscopy (FFBS). Location and nature of foreign body were noted, after which they were subjected to rigid bronchoscopy for the removal of FB. The patients were followed up for the complications due to the FB and due to the procedures. Patients with incidental finding of foreign body were also included in the study.

Data collected will be analyzed for the most common age, gender, presenting symptoms and signs, radiological findings and the location of the FB in the tracheobronchial tree. The role of FFBS in the diagnosis and follow up of complications due to FB will be analyzed. Statistical analysis will be done to find the correlation between the age of the child, duration of the retained FB to the complications due to FB.

Inclusion criteria

- Patients with suspected foreign body aspiration based on history and clinical features.
- Patients with accidental finding of foreign body in the lower respiratory tract when investigated for some other purpose.

Exclusion criteria

- Foreign bodies in upper airway and in gastrointestinal tract.

RESULTS

Total 162 children were suspected to have FB aspiration during this period of which 136 were found to have FBs in the tracheobronchial tree. Of the 136 children 53 children with definite evidence of FB were subjected to rigid bronchoscopy directly and 83 children required FFBS to diagnose FB (Table 1).

The age group of the children in the study ranged from six months to 12 years, with 86.03% being below the age of three years. Of the 136 children 97 were male and 39 were female with the male to female ratio of 2.4:1. In this study it was found that 69.12% (n=94) of the children were living in joint families with many siblings. Most of the children (62.5%, n=85) had working mothers, in which case the caretaker is someone else other than the mother.

A positive history of FB aspiration was present in 51.4% (n=70) patients. The duration between the time of aspiration and presentation varied from few hours to one year. Of the patients with a positive history of FB aspiration, only 45.71% (n=32) presented within 24 hours. Twentynine patients (41.43%) presented from 2 to 14 days. Nine patients (12.86%) presented after 14 days.

Table 1: Procedures done to diagnose and remove foreign bodies in airway.

Procedure	FB present	FB absent	Total
FFBS	83*	18	101
Rigid bronchoscopy done directly without FFBS	53	8	61
	136	26	162

*In all these cases rigid bronchoscopy was done after FFBS to remove the FBs

The most common symptom was cough in 59.56% (n=81) of cases, followed by respiratory distress in 54.41% (n=74) of cases. The most common sign was unilateral decrease in air entry present in 61.76% (n=84) of cases.

Radiological features were present in 86.03% (n=117) of cases due to foreign bodies. Obstructive emphysema was the commonest radiological feature in 48.53% (n=66) cases. Pneumonitis was present in 19.85% (n=27) cases, 13.23% (n=18) cases had collapse and 3(2.21%) cases had bronchiectasis changes. Three (2.21%) cases had radio opaque FBs. Chest X-ray was normal in 13.97% (n=19) of cases.

FFBS was done in 61.03% (n=83) cases. In cases with FB aspiration 22.89% (n=19) had granulation tissue. Repeat FFBS was required in 22 cases. All the cases with granulation tissue showed healing of the granulation tissue on follow up except one case which developed bronchial stenosis. Three cases had remnants of FBs.

Rigid bronchoscopy was done in all the cases to remove FBs. Three cases required repeat rigid bronchoscopy to remove the remnants. In one case FB could not be removed as there was a proximal stenosis.

Peanut FB was found in 64.71% (n=88) of the patients and coconut FB in 7.35% (n=10) patients. Types of FB are shown in (Table 2).

FBs were found in the right side in 50% (n=68) cases and in the left side in 38.24% (n=52) cases. 8.55% (n-13) had FB in the trachea. Two cases (1.47%) had FBs on both sides. In one case it was noticed that the FB was migrating on either side with varying findings in radiological images.

Thirty six percent (n=49) of the patients developed complications due to FBs. Pneumonia was the most common acute complication and bronchiectasis was the most common late complication. The complications due to FB are shown in Table 3.

Statistically 2.9% (n-4) cases developed complications following the procedure. Three cases developed

pneumothorax and pneumomediastinum of which 2 died. One case developed hypoxic encephalopathy.

Table 2: Types of airway FBs in children.

Foreign body	No. of patients	Percentage
Organic	129	94.85
Peanut	88	64.71
Coconut	10	7.35
Areca nut	6	4.41
Tamarind seed	6	4.41
Custard apple seed	5	3.68
Other Seeds	10	7.35
Bengal gram	2	1.47
Peanut hood	1	0.73
Coconut flower	1	0.73
Inorganic	7	5.15
Plastic object	3	2.21
Metallic object	3	2.21
Tablet	1	0.73
Total	136	100.00

Table 3: Complications due to foreign body aspiration.

Complications	No. of patients	Percentage
Pneumonia	27	55.10%
Collapse consolidation	18	36.74%
Late complications on follow up		
Bronchiectasis	3	6.12%
Bronchial stenosis	1	2.04%
Total	49	49

On follow up all the cases with pneumonia resolved and the cases with bronchiectasis continued to have the findings and were treated with physiotherapy. The case with retained FB continues to have it distal to the stenosis and is on regular follow up.

Statistical analysis showed that there was a significant correlation between, retained FB in the bronchus of more than 14 days duration and complications due to the FB (p value=0.04). It was also found that there was a significant correlation between the age and the complication (p=0.032). Children of less than 3 years of age were more prone to complications than children of older age group.

There was no significant correlation between the nature of FB or the site of FB and the complications.

DISCUSSION

Tracheobronchial FB aspiration is an important life threatening condition in young children. Children, less than 3years of age were most commonly affected, as like in other studies.[1-3] The younger group is more vulnerable because of the lack of adequate dentition i.e. they do not have premolars or molars and cannot grind smaller inhalable pieces effectively.[4] Additionally, among children of this age, introducing objects into their mouths is their way of exploring the world. This study showed a male predominance, which is in agreement with many other studies.[5-7]

In this series, only 51.47% of the cases had a definitive history of FB aspiration. When a FB is inhaled into the distal bronchial system without causing an acute obstruction, it may remain silent for a while depending on its nature. Organic materials cause a more severe mucosal inflammation, and granulation tissue may develop in a few hours. Furthermore, objects such as seeds, corn can absorb water, and with subsequent swelling, partial obstruction can change to total obstruction. On the other hand, patients who have inhaled small inorganic materials usually remain asymptomatic for a longer period of time unless total obstruction of a distal airway is caused.

Some of the cases presented only with acute onset breathlessness without any history or radiological features. So, a high index of suspicion is necessary to diagnose FB aspiration.

In patients with acute onset breathlessness and persistent radiological findings, FFBS could establish the diagnosis and localize the site of FB accurately.[8] With delay in removal, changes like granulation tissues, gush of purulent fluid, inflammatory changes and bronchiectasis changes were seen. In patients with such complications, repeat FFBS was done on follow up to look for any remnants.

Rigid bronchoscopy usually gives good results and it is the method of choice for removal of FBs.[9,10] The patients with definite evidence of FB aspiration were taken up for emergency rigid bronchoscopy. In most of the cases FBs were removed into and in the rest with long standing foreign bodies were removed in pieces. Only three cases required repeat rigid bronchoscopy for removal of remnants of FBs.

In 50.74% of the children FBs were found in the right side of the Tracheobronchial tree and in the left in 38.24%. In most of the adult studies it was shown that 70% of the FBs were in the right side and 30% in the left.[11-13] This is explained by the anatomical features of the right main bronchus, i.e. it is not as wide and the angulation of left main bronchus is not as acute as in adults.

Although a wide variety of FBs were removed, we observed that the peanut is the commonest FB, which is the same observation made by almost all the previous studies especially vegetable FB.[1,6,7] The propensity of finding a peanut in airways of children is probably due to its availability and affordability as compared to other nuts in India. The inorganic foreign bodies were more

common in older children and were mostly plastic objects used in toys.

Thirty six percent of the patients in this study had complications due to FBs. Patients who presented late were more prone to complications than who presented early. Persistent pneumonitis was the most common complication due to FBs. The most common late complication found on follow-up was bronchiectasis.[14] One case had bronchial stenosis with a FB distal to the stenosis and is on regular follow up.

One case had open safety pin in the bronchus. While removing, the head of the safety pin loosened and got retained in the bronchus. As the patient developed pneumothorax the procedure was abandoned. The child developed hypoxic encephalopathy subsequently.

There were two deaths in this study which presented late and died due to complications like pneumothorax/pneumomediastinum after removal.

When diagnosis is delayed, complications of a retained FB such as unresolving pneumonia, bronchial stenosis, and bronchiectasis may necessitate a surgical resection.

CONCLUSION

Foreign body aspiration is common in children less than 3 years of age. It is more common in males than in females. A definite history of FB aspiration is present only in 51% of cases. Radiological findings were present in 86.03% but normal in 13.97%. Persistent cough is the common presenting symptom and unilateral decreased air entry is the most common sign.

Obstructive emphysema is the most common radiological sign in children with FB aspiration. The most common complication following FB aspiration is persistent pneumonitis. FFBS is a very safe diagnostic modality which is helpful in making accurate diagnosis and also for ruling out FB. Rigid bronchoscopy is the method of choice for removal of FB. Peanut was the most common FB. The incidence of FB in left bronchus is almost as common as in right bronchus in children unlike adults. Retained FB in the bronchus of more than 14 days duration is significantly associated with complications

Key points of this study were as follows,

- Even in patients with negative history a high index of clinical suspicion is necessary to diagnose FB aspiration.
- Radiological findings were present in majority of the cases but can be normal also.
- FFBS further increases the diagnostic yield of FB aspiration.
- A negative FFBS helps to avoid unnecessary morbidity due to rigid bronchoscopy.

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