

Rigid Bronchoscopy for Foreign Body Removal in the Paediatric Airway: A Single-Center Perspective

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Abstract:

Aims & Objectives: To assess the epidemiological, clinical, radiological and endoscopic features of inhaled foreign bodies in children and the outcome following removal using rigid bronchoscopy.

Methods: This was a retrospective surveillance study conducted in the department of Paediatric Surgery of JSS Hospital, Mysore from January 2019 to September 2024. Children presented with clinical/radiological features suggestive of foreign body aspiration and underwent rigid bronchoscopy were included in the study. Demographic characteristics, presenting symptoms and its duration, examination and radiological findings, and outcome of bronchoscopy were analysed by descriptive statistical methods.

Results: 47 children (30 males and 17 females) underwent rigid bronchoscopy for suspicion of foreign body inhalation. They were aged from 6 months to 15 years out of which 35 (74.4%) were less than 3 years of age. Choking was the most frequently reported symptom in 23 (48.9%) cases, followed by noisy breathing, cough, and pneumonia all show the same frequency of 15 (31.9%). Delay between aspiration and removal was 1-15 days in 24 (51.06%) children and within 24 h in 15 (31.91%) children. The examination was normal in 6 (12.76%) children. The majority of the X-rays (51.1%) showed a normal finding followed by ipsilateral hyperinflation, consolidation and collapse in 29.8%, 6.4% and 4.3% respectively. Most common foreign body aspirated was peanuts (38.29%), and 74.5% was organic material. The foreign body was mostly lodged in right main bronchus (46.8%), followed by the left main bronchus (25.5%) and the trachea (14.9%). Procedure was successful in 91.48%, while no foreign body was noted in 8.51%. Total or partial failure of retrieval of foreign body was noted only in two children (4.3%).

Conclusion: These findings highlight the need for early diagnosis and high clinical suspicion in children presenting with features suggestive of foreign body aspiration. Public health initiatives should focus on parental education regarding reduction of risks and early presentation to hospital.

Keywords: Foreign Body Aspiration, Rigid Bronchoscopy, Inhaled Foreign Bodies, Paediatric Airway.

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Introduction

Foreign body aspiration (FBA) is a significant health concern in the pediatric population, particularly among children aged three years and younger that may cause accidental fatalities [1, 2]. This condition can lead to severe respiratory complications and is a leading cause of morbidity and mortality due to asphyxia in this age group [3].

The anatomical and developmental characteristics of young children, such as their natural curiosity and tendency to explore objects orally, contribute to the high incidence of FBA [3]. Approximately 70% of children are reported to have a witnessed choking event at the time of aspiration, with common clinical manifestations including sudden

onset of cough, dyspnea, and wheezing [4,5,6]. The clinical presentation of FBA can vary widely based on the type, size, and location of the foreign body within the airway. Radiological assessments, including chest X-rays and CT scans, play a crucial role in the diagnosis, although they may not always reveal clear findings, particularly since many aspirated objects are radiolucent [4,3].

The right main bronchus is often preferentially affected due to its wider and more vertical orientation, which predisposes it to foreign body lodging [5,7]. Rigid bronchoscopy is considered the gold standard for the diagnosis and management of tracheobronchial foreign bodies in

children. This technique allows for direct visualization and effective removal of aspirated objects while providing better airway control compared to flexible bronchoscopy [5,3]. Despite its effectiveness, rigid bronchoscopy carries risks such as airway edema, bleeding, and bronchospasm [5]. Therefore, understanding the epidemiological, clinical, radiological, and endoscopic features associated with inhaled foreign bodies is essential for optimizing treatment protocols and improving outcomes.

The aim of this study is to assess the epidemiological, clinical, radiological, and endoscopic features associated with inhaled foreign bodies in children, as well as to evaluate the outcomes following their removal using rigid bronchoscopy.

Materials and Methods

This retrospective study was conducted in the Department of Pediatric Surgery at JSS Hospital, Mysore, a tertiary care teaching hospital serving the districts of Mysuru, Chamarajanagar, Mandya, Coorg, and Hassan. We reviewed 47 cases of suspected foreign body aspiration in children under the age of 18, from January 2019 to September 2024.

The study included children who presented with clinical or radiological signs suggestive of foreign body aspiration and underwent rigid bronchoscopy under sedation. Data were collected from medical records and hospital databases.

Inclusion and Exclusion Criteria

Children below 16 years of age with confirmed foreign body aspiration (by radiological evaluation

or bronchoscopy) were included in the study. Children aged more than 15 years and those not given the consent were excluded from the study.

Statistical Analysis: Demographic characteristics, presenting symptoms with its duration, examination and radiological findings, and outcome of bronchoscopy were analysed by descriptive statistical methods.

Result

Out of the 47 aspirated pediatric patients aged between 6 months to 15 years, most of the children 35 (74.4%) were in the age group of 1-3 years. There were 30 (63.8%) male and 17 (36.2%) female children.

Only 12 (25.5%) patients were referred from the peripheral hospital for aspiration. Majority 25 (53.2%) of children were found unwitnessed about the foreign body ingestion while 22 (46.8%) were witnessed. Unsafe practice of feeding was noticed in 18 (38.3%) cases while 29 (61.7%) children followed safe practice of feeding. Delay between aspiration and removal was 1-15 days in 24 (51.06%) children and within 24 h in 15 (31.91%) children.

The examination was normal in 6 (12.76%) children. The majority of the X-rays (51.1%) showed a normal finding, indicating that more than half of the children had no notable abnormalities. Ipsilateral hyperinflation was the next most common finding at 29.8%, followed by consolidation and collapse in 6.4% and 4.3% respectively. X-rays findings are shown in figures 1-3.

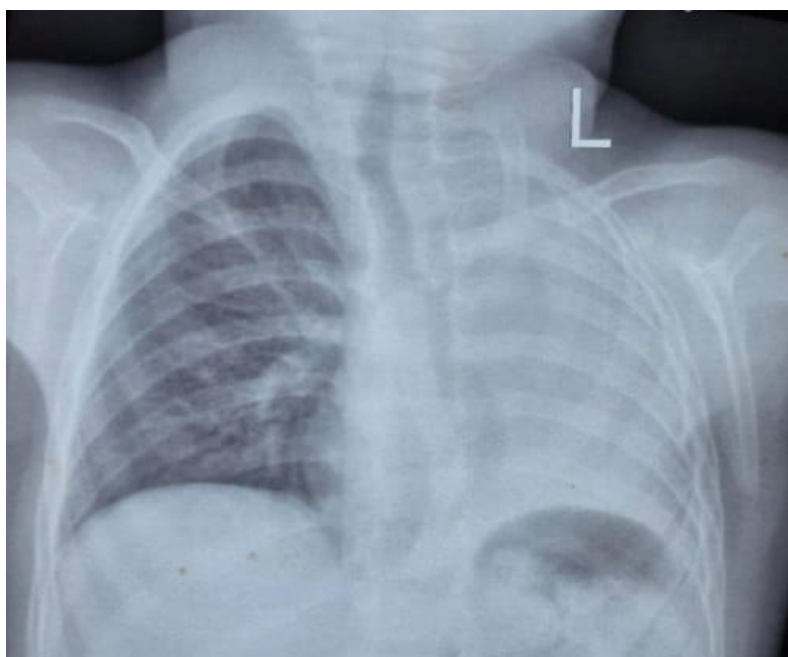


Figure 1: Collapsed lung secondary to left main bronchus foreign body

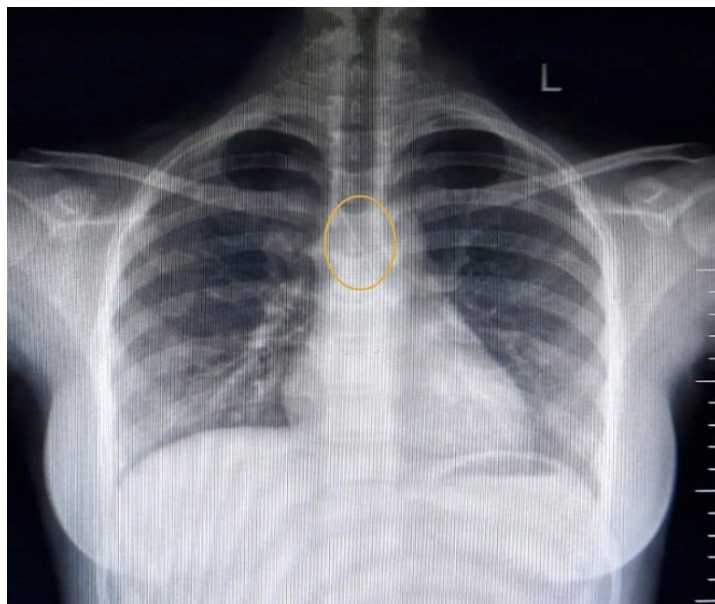


Figure 2: Metallic foreign body seen at the carina within the highlighted circle

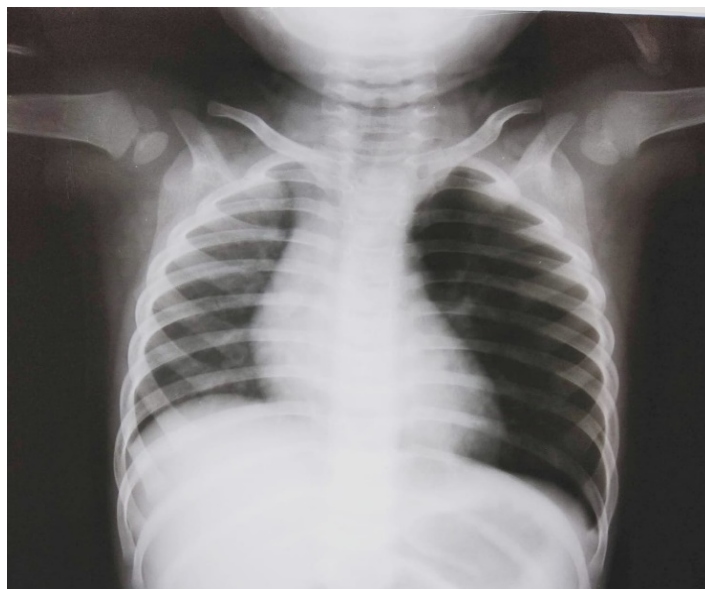


Figure 3: Hyperinflation of left lung secondary to left bronchial foreign body

Choking is the most frequently reported symptom in 23 (48.9%) cases, followed by noisy breathing, cough, and pneumonia all show the same frequency of 15 (31.9%). Respiratory distress is the least reported symptom with a frequency of 9, making up 19.1% of the total symptoms (table 1).

Table 1: Frequency of Symptoms

Symptoms	Frequency (f)	Percentage (%)
Choking	23	48.9
Noisy breathing	15	31.9
Cough	15	31.9
Pneumonia	15	31.9
Respiratory distress	9	19.1

Table 2: Types and location of aspirated foreign bodies in children (N=47)

Foreign bodies	Frequency (f)	Percentage (%)
Peanut	18	38.29
Almond	2	4.3
Areca nut	2	4.3
Garlic	2	4.3
Custard apple seed	2	4.3
Corn	2	4.3
Pin	2	4.3
Back of pen	1	2.1
Cashew	1	2.1
Coconut piece	1	2.1
Fruit	1	2.1
Guava	1	2.1
Nail	1	2.1
Orange fruit seed	1	2.1
Pistachio	1	2.1
Plastic piece	1	2.1
Plastic toy piece	1	2.1
Stone	1	2.1
Whistle	1	2.1
Unknown	1	2.1
Types of foreign bodies		
Organic	35	74.5
Inorganic	7	14.9
Location of foreign bodies		
Right main bronchus	22	46.8
Left main bronchus	12	25.5
Trachea	7	14.9
Bilateral bronchi	2	4.3

Nineteen different types of foreign bodies were removed (table 2; figure 4). Peanut is the most frequently aspirated item, with 18 (38.29%) cases. Other foreign bodies that were aspirated include almonds, areca nuts, garlic, custard apple seeds, corn, and pins, with each of these items having 2 cases each, amounting to 4.3% of the total.

Less common foreign bodies items such as the back of a pen, cashew, coconut piece, fruit, guava, nail, orange fruit seed, pistachio, plastic piece, plastic toy piece, stone, whistle, and an unknown object were aspirated only once each. Each of these accounts for 2.1% of the cases. No foreign bodies

were found in 4 (8.51%) cases. Organic types of foreign bodies were most common in 35 cases (74.5%) and inorganic type was found in 7 (14.9%).

The right main bronchus is the most frequent site for inhaled foreign bodies in 22 (46.8%) children, followed by the left main bronchus 12 (25.5%) and the trachea in 7 (14.9%) and then the bilateral bronchi in only 2 (4.3%) cases. Procedure was successful in 91.48%, while no foreign body was noted in 4 (8.51%) cases. Total or partial failure of retrieval of foreign body was noted only in two children (4.3%).



Figure 4: Various types of retrieved foreign bodies- from top left to bottom right pin, needle, custard apple seed, orange seed, whistle, plastic caps, peanut

Discussion

The present study aimed to assess the epidemiological, clinical, radiological and endoscopic features of inhaled foreign bodies in children and the outcome following removal using rigid bronchoscopy. This study found that the most frequently aspirated foreign body was peanuts (38.29%) of cases, followed by various other organic materials like almonds and areca nuts, each at 4.3%. A significant majority of foreign bodies were located in the right main bronchus (46.8%), followed by the left main bronchus (25.5%) and the trachea (14.9%). Organic materials comprised 74.5% of the aspirated foreign bodies, while inorganic materials accounted for 14.9%.

Our study reported that organic materials, particularly nuts, were the most common aspirated objects in children, corroborating the findings of the other previous studies [7,8,9,10,11,12,13,14]. The findings of this study emphasize the need for preventive measures regarding food offered to young children.

Research conducted by Mindru DE et al. [5] found that the right main bronchus is frequently involved in cases of foreign body aspiration, with their data showing a rate of 51.23% for right bronchial involvement, which aligns with the 46.8% reported in our study.

Other studies [8,10,12,13,15,16,17,18,19] are also consistent with the findings of the present study regarding more involvement of right bronchus followed by left bronchus. This consistency underscores anatomical factors influencing where aspirated objects are likely to lodge. Understanding why the right main bronchus is the most common site could be important for clinical practice and interventions, as the right main bronchus is wider and more vertically oriented than the left, making it an easier path for aspirated objects.

A retrospective analysis by Saki et al. [16] highlighted that children under three years old are at higher risk for aspiration incidents due to their developmental stage and exploratory behavior which is also similar to findings of Mohammad M et al. [9].

Our findings highlight the symptoms associated with foreign body aspiration (FBA) in children, indicating a significant prevalence of choking (48.9%), noisy breathing (31.9%), cough (31.9%), pneumonia (31.9%), and respiratory distress (19.1%). Major symptoms reported in our study, choking is also noticed by several previous studies [7, 12]. This is contrary to the findings of Dongol K et al. [14] who reported cough as the main clinical features of FBA. Male children were more affected in our current study which is consistent with the findings of Dongol K et al. [14].

Limitations

Potential limitations of this study include its retrospective nature, which may introduce biases related to data completeness and accuracy. Additionally, variations in clinical practice across different healthcare providers may affect the consistency of treatment outcomes.

Conclusion

The findings from the present study regarding types and locations of aspirated foreign bodies in children are largely supported by existing literature, particularly concerning the predominance of organic materials and specific anatomical sites like the right main bronchus. Future research should continue to explore these factors to enhance preventive strategies and clinical management for pediatric foreign body aspiration.

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