Profile of Pediatric patients with Foreign Body Aspiration requiring Bronchoscopy in a Tertiary Care Center

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ABSTRACT

Background

Foreign body aspiration (FBA) is a common pediatric emergency, particularly in children under five, due to immature airway protection reflexes and their tendency to explore objects orally. It is the fourth leading cause of accidental death in children under three, making early diagnosis and prompt management crucial.

Objective

To assess the profile of pediatric patients requiring bronchoscopy, identify associated clinical presentations, evaluate complications, identify the types of foreign bodies, and the most frequent site of lodgment.

Method

Clinical data of three years, from April 2021 to April 2024, were retrospectively collected from medical records. The study included children below 14 years of age who underwent rigid bronchoscopy for suspected foreign body aspiration at a tertiary care center. Their clinical profiles and various presenting symptoms were analyzed.

Result

Among 37 cases, the highest incidence (43.2%) was in children aged 1-3 years, with males comprising 73%. Cough and wheezing were the most common symptoms (19 cases). Organic foreign bodies, mainly peanuts and beans, were found in 22 cases, while metallic sharp objects (pins) were present in 5 cases. The right main bronchus was the most affected site (22 cases), and post-procedural pneumonia developed in 5 cases.

Conclusion

Foreign body Aspiration predominantly affects young children, with organic objects being the most common. Rigid bronchoscopy remains the gold standard for diagnosis and treatment, emphasizing the need for early intervention to prevent complications.

KEY WORDS

Airway obstruction, Bronchoscopy, Foreign bodies, Pediatrics, Respiratory aspiration

INTRODUCTION

Foreign body aspiration (FBA) in children is a common medical emergency, contributing to significant morbidity (10–20% worldwide).[1] In many countries, including the United States, it leads to thousands of emergency room visits annually and accounts for up to 5% of accidental deaths in children under four, making it a leading cause of fatal accidents in this age group.[2]

Infants and toddlers are particularly vulnerable due to their natural tendency to explore objects orally, incomplete dentition, eating while moving, and immature protective laryngeal reflexes.[3,4] Symptoms of FBA, including coughing, dyspnea, wheezing, cyanosis, and stridor, often mimic other respiratory conditions such as asthma and pneumonia. Consequently, diagnosis is frequently delayed, especially in unattended children with partial airway obstruction, increasing the risk of complications. Prompt recognition and intervention are essential to prevent morbidity and mortality.

Undiagnosed and retained foreign bodies can result in severe early and late complications, including asphyxia, pneumonia, atelectasis, and bronchiectasis.[5,6] Timely removal of suspected and confirmed aspirated foreign bodies is critical to reducing these risks.

The first successful bronchoscopic foreign body removal was performed in 1897 by Gustav Killian, who extracted a pork bone from an awake patient using cocaine as a local anesthetic.[7] Over the years, advancements in bronchoscopy, including the development of the Hopkins telescope-guided optical forceps and improved anesthetic techniques, have significantly enhanced the safety and efficacy of tracheobronchial foreign body removal.[8]

Understanding the profile of the patient, clinical presentation, types of foreign body, and complications is essential for timely management and thus reducing the morbidity and mortality in foreign body aspiration. The significant number of children presenting in this tertiary care center from April 2021 to April 2024, emphasizes its frequent occurrences and highlights the importance of early diagnosis and management.

METHODS

This retrospective observational study was carried out in the Department of ENT-HNS at Patan Academy of Health Sciences, Nepal. It included children under the age of 14 who underwent rigid bronchoscopy for suspected foreign body aspiration between April 2021 and April 2024. Ethical approval was obtained from the Institutional Review Committee of Patan Academy of Health Sciences (Ref: drs2403221843; dated March 22, 2024). Patients with duplicate records or incomplete medical data were excluded.

All children with a suspected history of foreign body aspiration were evaluated using chest X-rays and, when necessary, CT scans. Those with positive radiological findings proceeded to undergo rigid bronchoscopy under general anesthesia.

Intraoperative findings including the type and location of the foreign body, and any conditions such as bleeding, mucus, or pus were noted.

Postoperative assessments included monitoring for physical distress and relevant clinical or radiological signs such as reduced air entry, pneumonia, or pleural effusion.

Patients were discharged once they showed symptomatic improvement and had equal air entry on both sides of the chest.

Demographic data (age, gender), presenting symptoms, bronchoscopic findings (type and site of the foreign body), and any complications were recorded. The data was analyzed using Microsoft Excel (Version 16.49). All descriptive data were analyzed using mean, standard deviation, frequency, range, and percentages.

RESULTS

A total of 37 cases of foreign body aspiration were admitted from April 2021 to April 2024 (Table 1). The majority of cases (n=16) occurred in toddlers aged 1–3 years, indicating this group as the most vulnerable. Infants under 1 year of age accounted for 21.6% of cases. The majorities were male (n=27) while female children accounted for 10 cases (Table 2).

Table 1. Age distribution of the cases (n=37)

Age group	Frequency (%)
Less than 1 year	8 (21.6)
1 to <3 years	16 (43.2)
3 to 14 years	13 (35.1)
Total	37 (100)

Table 2. Gender distribution of the cases (n=37)

Gender	Frequency (%)
Male	27 (73)
Female	10 (27)
Total	37 (100)

Cough and wheezing were the most common presenting symptoms (n=19), followed by choking, respiratory distress, fever, noisy breathing, and seizures (Fig. 1).

Notably, one child experienced a convulsive episode immediately after aspiration, leading to loss of consciousness and seizure.

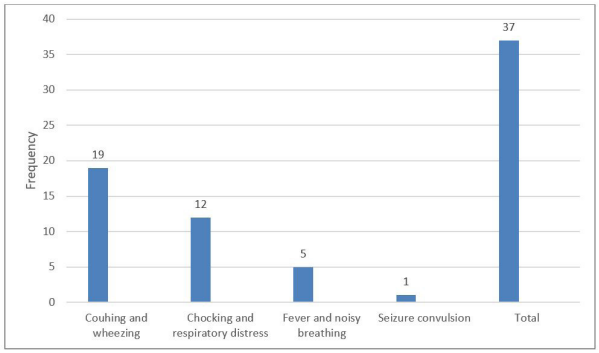

Figure 1. Distribution of the presenting symptoms (n=37)

Radiological and bronchoscopic findings revealed that the right main bronchus was the most frequent site of foreign body lodgment which was seen in 24 cases (Table 3, Fig. 2).

Table 3. Various sites for lodgment of foreign body (n=37)

Anatomical Site	Frequency (%)
Carina	1 (2.9)
Right Main Bronchus	24 (62.8)
Left Main Bronchus	12 (34.3)
Total	37(100)

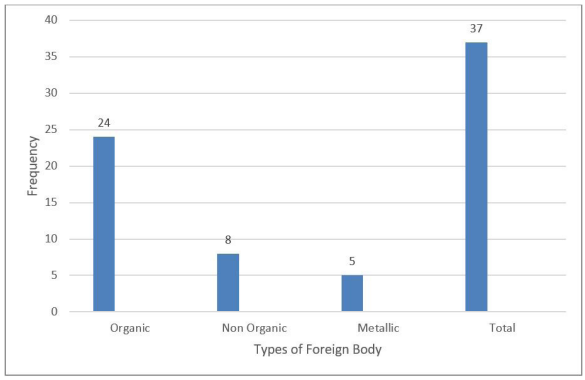

Figure 2. Distribution of Foreign Body (n=37)

The majority of aspirated objects were organic foreign bodies (n=24), with peanuts being the most common (n=6).

Among inorganic foreign bodies, pen caps (n=6) were the most frequently encountered. Additionally, metallic foreign body aspiration (n=5) was observed, with lead bulbs (n=3) being the predominant type (Table 4).

Complications were observed in 5 cases. Among these, pneumonia was the most common, occurring in four cases, while one case (n=1) developed a seizure secondary to hypoxemic brain injury (Fig. 3, Table 5).

DISCUSSIONS

Foreign body inhalation and aspiration is one of the serious medical emergencies worldwide and can be seen in any age group; however it is more common in the pediatric population, particularly among toddlers (1-3 years of age).[9,10]

In our study, the toddler age groups i.e., 1 to 3 years are the most affected, accounting for 16 numbers of cases. Similar findings were noted in the study by The European Survey on Foreign Bodies Injuries (ESFBI) which showed the significant number of aspiration cases were observed in children around 2 years of age.[11] The increased incidence of

Table 4. Distribution of various types of foreign bodies (n=37)

Types of Foreign Body	Frequency (n)
Beans	2
Betel Nuts	1
Bone	2
Cashew Nuts	4
Chickpeas	1
Coffee Beans	1
Gram Beans	1
Lead Bulb	3
Maize seeds	3
Wheat Twigs	1
Green Peas	1
Pen Caps	6
Pen Lid	1
Sugar Cane Piece	1
Thumb pin	2
Peanuts	6
Walnut	1
Total	37

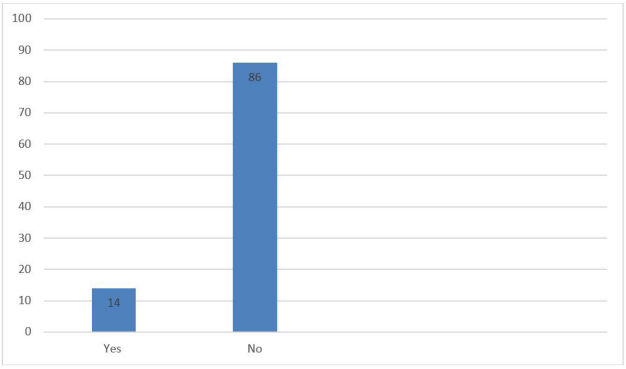

Figure 3. Distribution of the complications (n=37)

Table 5. Complications encountered in children with foreign body aspiration

Complications	Frequency(n)
No	32
Pneumonia	4
Seizures	1
Total	37

aspiration in toddlers is commonly associated with several factors, like, incomplete dentition, a natural tendency to explore their environment by placing objects in their mouth, and episodes of forceful inhalation during activities such as laughing, crying, or running while eating.

The present study showed a gender-based variation in foreign body aspiration, with male children (n=27) being at a relatively higher risk compared to females (n=10). A study by Ayed et al. also suggest that males are more susceptible to aspiration than females.[12] This increased risk among boys may be attributed to their more impulsive and adventurous behavior.

Foreign body aspiration is typically identified based on clinical features such as sudden onset of choking, apnea, diminished breath sounds, lung atelectasis, air trapping, and mediastinal shift. These hallmark signs were outlined by Heller, who proposed a diagnostic model emphasizing seven key features for identifying foreign body aspiration. According to Heller's model, which has an accuracy of 91%, the presence of any three of these features strongly supports the diagnosis.[13]

In the present study, findings were consistent with Heller's model. The most common presenting symptoms were cough and wheezing in 19 cases, followed by choking or respiratory distress in 12 cases. Additional symptoms included fever with noisy breathing in five cases, and a single case presented with convulsions. The presence of symptoms such as fever and seizures may be attributed to prolonged retention of the foreign body or its location most likely in the trachea leading to partial or complete airway obstruction. This obstruction could have resulted in transient hypoxemia, potentially causing neurological symptoms such as seizures due to reduced oxygen supply to the brain.

Apart from the strong clinical suspicion and alleged history of foreign body aspiration the clinical investigation plays a strong role for the diagnosis of the foreign body aspiration.

Chest radiography is usually the first step in evaluating suspected foreign body aspiration. Ideally, both inspiratory and expiratory radiographs are done among the cooperative children, while decubitus radiographs are best for younger or the uncooperative ones.[14] Most foreign bodies are radiolucent and may not appear on standard radiographs thus the signs of aspiration include unilateral lung hyperinflation, consolidation, and tracheal or mediastinal shift, depending on the object's location.[15,16] Importantly, normal chest radiographs do not rule out aspiration, as nearly 50% of cases may have normal findings. Therefore, a computed tomography (CT) scan should be considered when the diagnosis is unclear.[2] In our study, most patients underwent chest radiography as the initial radiological test. In cases where the foreign body was clearly visible particularly non-organic or metallic objects; no further imaging was done. However, patients with findings such as lung collapse, hyperinflation, or air trapping were subsequently evaluated with CT of the chest.

Parameswaran et al. and Chiu et al. have reported that organic materials are more commonly aspirated than inorganic ones.[17,18] Similar findings were observed in this study, where organic foreign bodies were identified in 24 cases, compared to 13 cases which had inorganic materials. Among the organic aspirates, peanuts were the most frequently encountered (n=6). In the inorganic group, pen caps were the most common, also reported in six cases. However, the type of organic foreign body aspiration usually depends on the availability of the food in that particular demographic region or the food culture. Both the organic and inorganic foreign bodies pose a high risk to the airways through different mechanism. Organic materials, if retained for longer period of time can swell due to water absorption and break into smaller pieces. This characteristic poses a danger, as patients with partially obstructed airways can experience complete airway blockage. Furthermore, the fragments of these broken foreign bodies can become lodged deeper in the airway during bronchoscopy, making their removal difficult. In contrast, inorganic materials may lead to sudden and complete obstruction of the tracheobronchial system, resulting in acute upper airway obstruction.

In this study, the right main bronchus was the most common site of foreign body lodgment. Similar findings have been reported in studies by Kaur et al. and Cassol et al.[15,19] This predilection is commonly attributed to the anatomical structure of the right bronchus, which is shorter, wider, more vertical, and has a larger diameter compared to the left bronchus.[17,20,21]

Bronchoscopy either rigid or flexible remains the cornerstone for both the diagnosis and management of foreign body aspiration. In cases where there is a clear history of choking or aspiration followed by positive clinical and radiological findings, bronchoscopy is routinely performed. However, its diagnostic purpose is important in situations where there is no clear history, especially in unattended children presenting with strong clinical suspicion.

In the present study, all 37 children underwent successful rigid bronchoscopy based on a documented history of foreign body aspiration, clinical and radiological findings. Rigid bronchoscopy under general anesthesia continues to be the most effective and widely accepted technique for the retrieval of aspirated foreign bodies.[22-25] The availability of modern pediatric bronchoscope instruments has further enhanced the safety and precision of the procedure, enabling effective ventilation and accurate foreign body removal under direct visualization.[26,27]

In this study, complications were observed in five cases, with pneumonia being the most commonly reported (n=4). Complications can be seen either due to retained foreign body for longer duration of time and or type of the foreign body (metallic, non-metallic, organic, inorganic). Moreover, the complications can occur during bronchoscopic removal even in the hands of experienced practitioners. Potential risks include difficult extraction, laryngeal edema, pneumothorax, pneumomediastinum, subcutaneous emphysema, and, in some instances, the requirement for tracheotomy or assisted ventilation. More severe adverse events such as hypoxic brain injury, bradycardia, cardiopulmonary arrest, and even mortality have also been documented.[28,29]

As this study is a retrospective study, the records of many patients may be missing. Also, due to the small sample size and being a single-center study, it may not truly reflect the outcome.

CONCLUSION

Foreign body aspiration is a common medical emergency among the pediatric population, especially among the toddler group. Most of the aspiration materials are usually organic, and among them, peanuts are commonly seen. The right main bronchus is the common site for the lodgment of the aspirates due to its anatomy. Rigid bronchoscopy remains the important diagnostic and therapeutic intervention. Early identification of the clinical signs and symptoms thus prevents the morbidity and mortality associated with this condition.

CONCLUSION

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