Journal of Medical and Health Studies
ISSN: 2710-1452
DOI: 10.32996/jmhs
Journal Homepage: www.al-kindipublisher.com/index.php/jmhs

JMHS
AL-KINDI CENTER FOR RESEARCH AND DEVELOPMENT

| RESEARCH ARTICLE

Challenges in Pediatric Foreign Body Aspiration: A Case Report on Persistent Bronchial Obstruction and Aspiration Pneumonia

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| ABSTRACT

Foreign body aspiration is a common and potentially dangerous event in young children, often leading to emergency department visits. Our case study presents a 2-year-old boy who aspirated multiple nuts, leading to choking and respiratory distress. The child initially experienced cyanosis and was later found to have decreased air entry on the right side of the chest, prompting the need for bronchoscopy. The initial tolerance for the procedure was low, with frequent loss of saturation, and despite multiple attempts, the bilateral and deep nature of the foreign body resulted in the child being intubated and admitted to the Pediatric Intensive Care Unit (PICU). Over the following days, the child underwent multiple combined bronchoscopies, utilizing flexible and rigid and a staged approach to clear the lungs. This was a combined treatment alongside antibiotics and dexamethasone for inflammation and infection prevention. The child experienced behavioral changes post-extubation, managed with psychiatric support and physiotherapy. This case emphasizes the need for early intervention, the importance of an interventional toolkit, and, at times, multidisciplinary or combined approaches to ensure complete recovery from foreign body aspiration incidents in children.

| KEYWORDS

Airway obstruction, bronchoscopy, child behavior, pediatric intensive care, respiratory distress.

| ARTICLE INFORMATION

ACCEPTED: 01 October 2024 **PUBLISHED:** 05 October 2024 **DOI:** 10.32996/jmhs.2024.5.4.3

1. Introduction

Foreign body aspiration (FBA) in children is a critical medical emergency that poses significant risks to pediatric health, often requiring immediate intervention to prevent serious complications. It is a leading cause of accidental injury and death among children, particularly those under the age of three, due to their natural curiosity and tendency to explore objects orally [Mîndru, 2023]. The incidence of FBA is reported to be about 109.6 per 100,000 children in 2019, with a higher prevalence in developing countries where healthcare access might be limited or delayed [Wu, 2023]. Various factors contribute to FBA in children, including age, developmental stage, and the availability of small objects or food items that can be easily aspirated [Cramer, 2024]. This condition necessitates timely recognition and management to avoid long-term respiratory complications, as well as the potential for severe morbidity or mortality [D'Addio, 2022].

The presentation of FBA can be deceptively subtle, with symptoms often mimicking other respiratory conditions such as asthma or bronchitis. Common symptoms include coughing, wheezing, and stridor, but these can vary significantly depending on the

object's size, type, and location within the airway [Teshome, 2013]. If not promptly diagnosed, FBA can lead to severe consequences such as persistent bronchial obstruction, aspiration pneumonia, and even death. These complications stress the critical importance of early diagnosis and intervention [Wright, 2008]. Despite advancements in diagnostic imaging and bronchoscopy techniques, there remains a significant challenge in accurately identifying and retrieving aspirated foreign bodies, particularly in young children who may be uncooperative or unable to communicate their distress effectively.

Several studies have highlighted the clinical challenges and diagnostic strategies involved in pediatric FBA. For instance, a study by Shostak et al. (2018) emphasized the role of high-resolution computed tomography (CT) and flexible bronchoscopy as pivotal tools in the accurate diagnosis and retrieval of aspirated objects. Another study by Hewlett et al. (2017) highlighted that although bronchoscopy remains the gold standard for FBA management, it is not without risks and challenges, particularly in cases involving prolonged impaction or when dealing with sharp or large objects that may damage the airway during retrieval. A study by Ünal et al. (2022) discussed the introduction of new-generation bronchoscopes equipped with better visualization capabilities and suction mechanisms that enhance the retrieval process while minimizing trauma to the airway. These technological improvements are particularly beneficial in complex cases where traditional methods might pose increased risks.

Despite the progress in understanding and managing pediatric FBA, there are notable gaps in the literature regarding the long-term management of complications such as persistent bronchial obstruction and aspiration pneumonia. Existing studies primarily focus on immediate diagnosis and retrieval techniques, leaving a critical gap in understanding the subsequent treatment and monitoring of affected children. Additionally, while technological advancements have been noted, their accessibility and implementation in developing regions remain inadequately addressed. Our case report aims to fill these gaps by providing detailed insights into the long-term management of FBA complications and examining the efficacy of combined and multidisciplinary bronchoscopic techniques in persistent cases.

2. Case Presentation

A 2-year-old previously healthy boy presented to the emergency department (ED) with a history of choking on mixed nuts earlier in the day. According to the father, the child was in his usual state of health until he was given a snack of mixed nuts in the morning, at which point he began to choke and developed cyanosis for a brief moment. Following this episode, the child experienced grunting and sleep disturbances. No loss of consciousness, fever, or abnormal movements were reported, and no changes in voice were observed.

Upon initial examination, the child appeared generally well and active but was in mild respiratory distress, with an oxygen saturation of 88% on room air. Physical examination revealed decreased air entry on the right side of the chest with no added sounds. The cardiovascular examination showed normal heart sounds, and the abdominal examination was unremarkable. A chest X-ray showed hyperinflation (Figure 1),

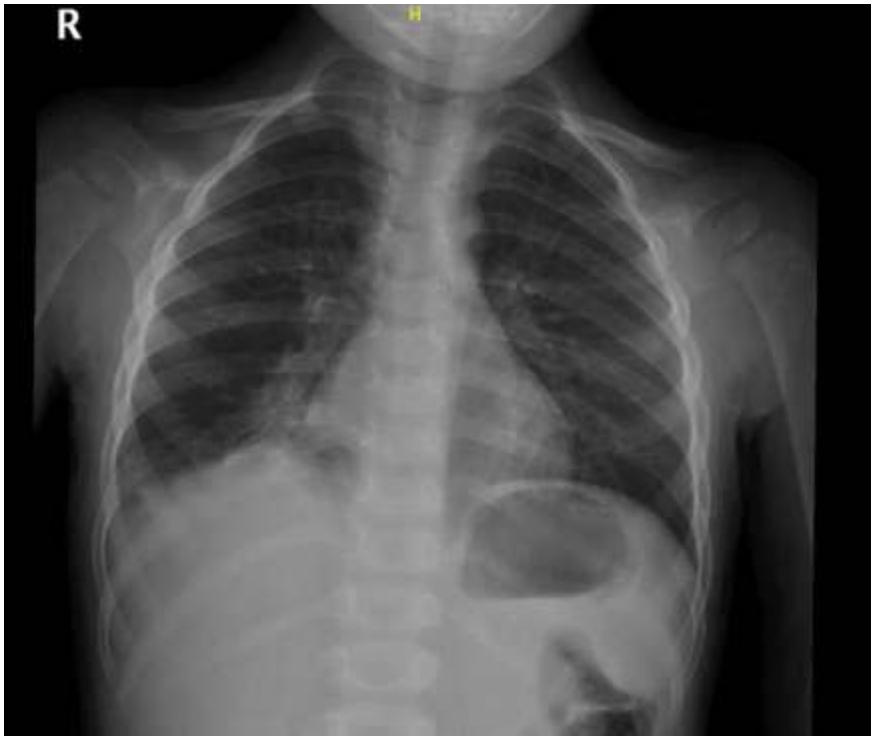

Figure 1. Chest X-ray on arrival demonstrating pulmonary hyperinflation leading to a plan for bronchoscopy to remove the suspected foreign body.

The patient underwent an initial rigid bronchoscopy, which revealed a foreign body lodged in the right bronchus surrounded by a significant amount of secretion (Figure 2).

Figure 2. Nut fragments in segmental right bronchi.

Despite multiple attempts, the foreign body was pushed distally, and the child's saturation was tenuously unstable, but the pulse rate was normal throughout. The child was intubated, and a removal via flexible bronchoscopy was attempted. At this point, surgical attempts were limited due to low procedural tolerance and prolonged desaturation and cyanosis. Due to this, the child was shifted to the Pediatric Intensive Care Unit (PICU) for further management, where he was sedated and placed on mechanical ventilation and anti-inflammatory while awaiting additional bronchoscopic attempts.

The following day, the child underwent combined bronchoscopy procedures using a multidisciplinary approach with an interventional pulmonologist and an otolaryngologist, and the right lung was cleared. At this point, extensive deep left sided nut fragments were discovered as well. The team elected to stage the second lung removal to allow the right lung to re-expand and better tolerate the removal. After this, two more bronchoscopic procedures were performed, resulting in near complete clearance of tiny fragments in the most distal subsegments (Figure 3, 4).

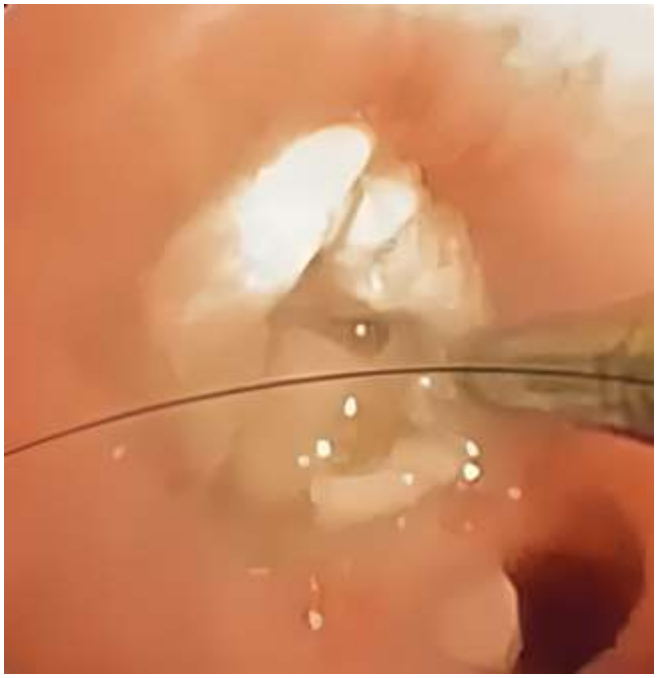

Figure 3. Basket extraction via flexible bronchoscopy.

Figure 4. Fragments of peanut and almond skin removed from right bronchus

Despite these interventions, the child developed a spike in fever and clinical symptoms suggesting pneumonia. The child was maintained on antibiotics and dexamethasone to manage pulmonary edema and inflammation. Afterward was extubated shortly and transitioned to a nasal cannula for oxygen support.

Post-extubation, the child exhibited behavioral changes, including reduced speech and social interaction. He was observed to be lethargic and had lost weight, only responding with minimal verbal communication when prompted. A psychiatric evaluation was conducted, indicating no major mental illness but suggesting a normal stress reaction, likely due to the traumatic medical experiences. The child's feeding was managed through a nasogastric tube, and swallowing assessments were initiated to facilitate the transition to oral intake.

Over the next several days, the child's respiratory status improved, and he was gradually weaned off oxygen support. He began to tolerate oral and liquid intake and showed signs of regaining strength and activity levels. Continued improvement was noted in his respiratory function, with diminished wheezing and crepitation on the right lower lobe of the lung. The care team planned for further psychiatric support and physiotherapy consultations to address any residual psychological and physical effects of the incident.

After consultation, the child's condition had significantly improved, with stable vital signs, normal breathing patterns, and adequate oral intake. He was discharged with follow-up appointments arranged to monitor his recovery and ensure complete resolution of symptoms related to the foreign body aspiration (Figure 5)

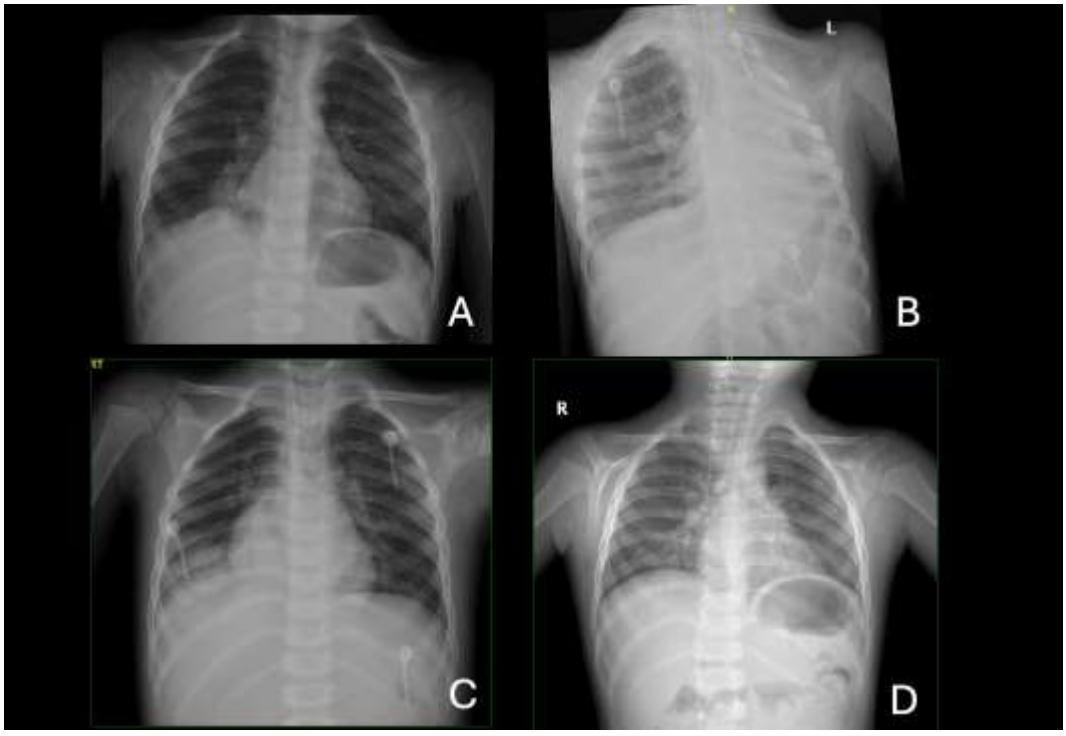

Figure 5: (A) Chest X-ray on arrival to ED, (B) Chest X-ray on day 2, (C) Chest X-ray on day 4, (D) Chest X-ray on 2 weeks after discharge.

3. Discussion

This case of a 2-year-old boy with foreign body aspiration highlights several critical aspects of pediatric airway management and the potential complications associated with it. The initial presentation of choking, cyanosis, and respiratory distress, alongside the subsequent need for bronchoscopy, underscores the immediate and potentially life-threatening nature of foreign body aspiration in children. The prevalence of such incidents in young children is significant, with studies indicating that foreign body aspiration accounts for a notable percentage of pediatric emergency visits and hospitalizations worldwide [Mîndru, 2023; Dongol, 2021]. The importance of early recognition and intervention cannot be overstated, as delayed treatment can lead to severe complications such as airway obstruction, infection, and long-term pulmonary damage [Rose, 2024]. In this case, the child's initial mild respiratory distress with decreased oxygen saturation was a clear indicator of partial airway obstruction, necessitating urgent medical attention.

Bronchoscopy remains the gold standard for both diagnosis and treatment of foreign body aspiration in children, as evidenced by its use in this case for the attempted removal of the lodged nut fragments. The choice between rigid and flexible bronchoscopy often depends on the location and nature of the foreign body, as well as the expertise and availability of the medical team. According to a study by Ganie et al. (2014), rigid bronchoscopy is typically preferred for foreign bodies in the trachea or main bronchi due to its superior ability to secure the airway and remove large or impacted objects. In this case, the initial failure to retrieve the nuts, despite multiple attempts, illustrates the challenges sometimes faced during bronchoscopy, particularly when dealing with friable or fragmented foreign bodies. This difficulty is supported by other literature, which reports that success rates can vary based on the foreign body's consistency and the duration it has been lodged in the airway [Hasdiraz, 2006].

The decision to admit the child to the PICU for further management highlights the severity of the situation and the potential for complications. The administration of antibiotics and dexamethasone was aimed at controlling inflammation and preventing secondary infections, a strategy supported by several studies emphasizing the role of corticosteroids in managing post-obstructive pulmonary complications [Falk, 2008]. The use of mechanical ventilation and sedation while awaiting further bronchoscopy underscores the delicate balance required in managing airway patency while preventing further injury or distress to the patient. A study by Diaz et al. (2024) confirms that while mechanical ventilation is often necessary, it also comes with risks of barotrauma and infection, necessitating careful monitoring and judicious use of supportive therapies.

Behavioral changes following extubation, as observed in this case, are not uncommon and are often a result of the traumatic nature of the medical interventions experienced by the child. The reduced speech and social interaction, alongside lethargy and weight loss, suggest a significant psychological impact, potentially exacerbated by prolonged hospitalization and invasive procedures.

Similar findings have been documented in studies exploring the psychological sequelae of pediatric intensive care stays, where children frequently exhibit signs of stress and anxiety post-discharge [Ko, 2022]. The psychiatric evaluation in this case indicated a normal stress reaction, suggesting that while such reactions are typically transient, they may require supportive care to facilitate recovery and reintegration.

The improvement in respiratory status and the gradual weaning off oxygen support observed in this patient reflect the natural course of recovery following the successful removal of the foreign body and resolution of the associated inflammatory response. Studies by Sarkar et al. (2020) have demonstrated that with appropriate intervention, children often exhibit rapid pulmonary recovery, although close monitoring is crucial to detect any potential residual effects or complications.

The child's eventual discharge with stable vital signs, normal breathing patterns, and adequate oral intake marks a successful resolution of this complex medical case. This outcome emphasizes the effectiveness of coordinated surgical and medical interventions and the critical role of follow-up care in ensuring complete recovery.

4. Conclusions

This case of a 2-year-old boy with nuts lodged in his airway highlights the serious risks of foreign body aspiration in young children and the importance of quick medical intervention. The child's journey from choking and respiratory distress to recovery shows the crucial role of bronchoscopy in diagnosing and removing foreign bodies from the airway. Additionally, it emphasizes the importance of a holistic approach to care, including psychiatric support and physiotherapy, to address both the physical and psychological impacts of such incidents. Through careful monitoring and multidisciplinary care, the child was able to recover fully and resume normal activities, highlighting the importance of vigilance and comprehensive care in pediatric health emergencies.

Funding: This research received no external funding
Conflicts of Interest: The authors declare no conflict of interest.
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