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A comprehensive analysis of foreign body aspiration: Case series

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Abstract
Background: Foreign body aspiration (FBA) is a critical medical emergency, particularly in pediatric patients. Prompt recognition and intervention are essential to prevent complications and improve patient outcomes.
Objective: This case series aimed to investigate the demographic characteristics, clinical presentation, diagnostic methods, management strategies, and outcomes of patients with FBA.
Methods: Retrospective analysis of 50 cases of FBA. Data on demographic information, clinical presentation, diagnostic investigations, management approaches, and outcomes were collected from electronic medical records.
Results: The study included 50 cases of FBA, with a predominance of pediatric patients. Common symptoms included coughing, choking, and wheezing. Diagnostic evaluation with chest X-rays and bronchoscopy confirmed FBA in all cases. Management strategies varied, with endoscopic retrieval being the preferred approach. Successful removal of the foreign body was achieved in the majority of cases, with minimal complications.
Conclusion: This case series provides valuable insights into the epidemiology, clinical presentation, diagnostic methods, management strategies, and outcomes of patients with FBA. Early recognition and intervention are crucial to prevent complications and improve patient outcomes. Keywords: Foreign body aspiration, Pediatrics, Bronchoscopy, Diagnostic imaging, Management.
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Introduction

Foreign body aspiration (FBA) poses a significant challenge in clinical practice, particularly in pediatric patients, where it represents a common cause of respiratory emergencies. FBA occurs when a solid or liquid object is inhaled into the airways, leading to partial or complete obstruction. While pediatric populations are most commonly affected due to their exploratory behaviors and incomplete airway protection mechanisms, cases of FBA in adults are also reported, often associated with underlying anatomical or neurological abnormalities, as well as impaired protective reflexes. The clinical presentation of FBA can vary widely, ranging from acute respiratory distress and choking to more subtle symptoms such as chronic cough or recurrent respiratory infections. However, diagnosing FBA can be challenging, especially in cases with nonspecific symptoms or negative imaging findings. Diagnostic modalities such as chest X-rays, computed tomography (CT) scans, and bronchoscopy play crucial roles in confirming FBA and guiding appropriate management strategies [1-5].

The management of FBA requires a multidisciplinary approach involving emergency physicians, otolaryngologists, pulmonologists, and thoracic surgeons. Treatment options range from conservative measures such as coughing maneuvers and chest physiotherapy to more invasive interventions such as bronchoscopic removal or surgical extraction. The choice of intervention depends on various factors, including the type, size, and location of the aspirated foreign body, as well as the patient's age, clinical condition, and available resources [2-6].
Despite advancements in diagnostic and therapeutic techniques, FBA remains associated with significant morbidity and mortality, emphasizing the need for further research to optimize clinical outcomes and enhance patient safety. This introduction aims to provide an overview of FBA, highlighting its clinical significance, diagnostic challenges, management approaches, and areas for future investigation.

Materials and Methods

This retrospective case series aimed to analyze the demographic characteristics, clinical presentation, diagnostic methods, management strategies, and outcomes of patients diagnosed with foreign body aspiration (FBA) at a tertiary care center between 2020-2023. Institutional Review Board approval was obtained prior to data collection.

Patient Selection Criteria: Patients included in the study met the following criteria:

- Diagnosis of FBA confirmed by bronchoscopy or radiographic evidence.
- Age ranging from pediatric to adult populations.
- Availability of complete medical records including demographic information, clinical presentation, diagnostic evaluations, treatment interventions, and follow-up data.

Data Collection: Electronic medical records were retrospectively reviewed to collect relevant data. Information regarding patient demographics (age, gender), clinical presentation (symptoms, duration), diagnostic investigations (chest X-rays, CT scans, bronchoscopy), management approaches (conservative measures, endoscopic retrieval, surgical intervention), and outcomes (resolution of symptoms, complications) was extracted.

Statistical Analysis: Descriptive statistics were used to summarize the collected data, including frequencies, means, standard deviations, and ranges. Categorical variables were presented as frequencies and percentages, while continuous variables were summarized using means and standard deviations. Statistical analysis was performed using appropriate software (SPSS ver 21), with significance set at $p < 0.05$.

Ethical Considerations: This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Patient confidentiality and privacy were strictly maintained throughout the data collection and analysis process. No identifiable patient information was included in the manuscript to ensure anonymity and compliance with ethical standards.

Limitations: Limitations of this study include its retrospective design, which may introduce selection bias and limitations in data availability. Additionally, the study's single-center nature may limit the generalizability of the findings to other healthcare settings. Despite these limitations, this case series provides valuable insights into the clinical characteristics and management of FBA, contributing to the existing literature on this topic.

Results

A total of 50 cases of foreign body aspiration (FBA) were identified and included in the analysis. The demographic characteristics, clinical presentation, diagnostic methods, management strategies, and outcomes of these cases are summarized below.

Table 1: Demographic Characteristics of Patients with Foreign Body Aspiration

The demographic analysis revealed that the study population comprised 35 pediatric patients and 15 adult patients. Among pediatric patients, the mean age was 3.5 years (±1.2), with a male predominance (22 males, 13 females). In contrast, among adult patients, the mean age was 45.2 years (±6.7), with a relatively equal distribution of males and females (8 males, 7 females).

Table 2: Clinical Presentation of Patients with Foreign Body Aspiration

The clinical presentation of patients with foreign body aspiration predominantly included coughing (96%), choking (84%), and wheezing (76%). Additional symptoms such as dyspnea (40%) and cyanosis (24%) were also observed, albeit less frequently.

Table 3: Diagnostic Methods and Findings in Patients with Foreign Body Aspiration

Chest X-ray was performed in all cases and yielded positive findings in 80% of patients, supporting the diagnosis of foreign body aspiration. Computed tomography (CT) scans were conducted in 40% of cases, with a higher yield of positive findings (90%). Bronchoscopy, performed in 90% of cases, confirmed the presence of foreign bodies in the airways.

Table 4: Management Strategies and Outcomes in Patients with Foreign Body Aspiration

Management strategies varied among patients with foreign body aspiration. Conservative measures were employed in 30% of cases, primarily in those with less severe symptoms or radiographic evidence of small, distal foreign bodies. Endoscopic retrieval was the preferred approach in 60% of cases, with successful removal achieved in 93.3% of these cases. Surgical intervention was required in 10% of cases, typically for large, proximally located foreign bodies or in cases of failed endoscopic retrieval. Complications were infrequent, with a higher incidence observed following surgical intervention (20%) compared to endoscopic retrieval (6.7%). Overall, the majority of patients experienced resolution of symptoms and favorable outcomes following appropriate management interventions.

Table 1: Demographic Characteristics of Patients with Foreign Body Aspiration

Demographic Characteristic	Pediatric Patients (n=35)	Adult Patients (n=15)
Mean Age (years)	3.5 ± 1.2	45.2 ± 6.7
Gender (Male:Female)	22:13	8:7

Table 2: Clinical Presentation of Patients with Foreign Body Aspiration

Clinical Presentation	Frequency (%)
Coughing	48 (96%)
Choking	42 (84%)
Wheezing	38 (76%)
Dyspnea	20 (40%)
Cyanosis	12 (24%)

Table 3: Diagnostic Methods and Findings in Patients with Foreign Body Aspiration

Diagnostic Method	Frequency (%)	Positive Findings (%)
Chest X-ray	50 (100%)	40 (80%)

Computed Tomography	20 (40%)	18 (90%)
Bronchoscopy	45 (90%)	N/A

Table 4: Management Strategies and Outcomes in Patients with Foreign Body Aspiration

Management Strategy	Frequency (%)	Successful Removal (%)	Complications (%)
Conservative Measures	15 (30%)	N/A	N/A
Endoscopic Retrieval	30 (60%)	28 (93.3%)	2 (6.7%)
Surgical Intervention	5 (10%)	4 (80%)	1 (20%)

Discussion

Foreign body aspiration (FBA) represents a significant medical emergency, particularly in pediatric populations, where it is a leading cause of respiratory morbidity and mortality. This discussion aims to delve deeper into the findings of our case series and contextualize them within the existing literature, while also highlighting clinical implications and avenues for future research.

Epidemiology and Demographic Patterns

The demographic analysis of our case series revealed a predominance of pediatric patients, consistent with previous studies highlighting the vulnerability of children to FBA due to their exploratory behaviors and incomplete airway protective mechanisms [1]. The age distribution of our pediatric patients underscores the importance of age-appropriate preventive measures and parental supervision to minimize the risk of FBA, particularly in toddlers and young children who are most at risk [2,8-10].

Clinical Presentation and Diagnostic Challenges

The clinical presentation of FBA can vary widely, ranging from acute respiratory distress and choking to more subtle symptoms such as chronic cough or recurrent respiratory infections [3]. Our findings align with previous literature, with coughing, choking, and wheezing being the most commonly reported symptoms. However, diagnosing FBA can be challenging, especially in cases with nonspecific symptoms or negative imaging findings. The utility of diagnostic modalities such as chest X-rays, computed tomography (CT) scans, and bronchoscopy is well-established in confirming FBA and guiding appropriate management strategies [4]. Despite the high sensitivity of bronchoscopy, its availability and expertise may be limited in certain settings, underscoring the need for alternative approaches such as rigid bronchoscopy or surgical exploration [5-10].

Management Strategies and Outcomes

Our case series demonstrated a diverse range of management strategies employed in patients with FBA, including conservative measures, endoscopic retrieval, and surgical intervention. Conservative measures were primarily reserved for patients with less severe symptoms or distally located foreign bodies, where expectant management or supportive care may suffice. Endoscopic retrieval emerged as the preferred approach in the majority of cases, offering a minimally invasive and effective means of foreign body removal. The success rate of endoscopic retrieval in our series was high, corroborating previous studies highlighting its efficacy as a first-line intervention in uncomplicated cases of FBA [6]. Surgical intervention, although less frequently utilized, was reserved for cases with complex or proximally located foreign bodies, failed endoscopic retrieval attempts, or complications such as airway perforation or hemorrhage. While associated with a higher risk of complications, surgical

intervention remains a valuable therapeutic option in select cases where endoscopic retrieval is deemed insufficient or contraindicated.

Comparative Literature and Clinical Implications

Comparative literature demonstrates varying success rates and complication profiles associated with different management techniques, emphasizing the importance of individualized treatment plans based on patient characteristics and clinical judgment. Studies have reported overall favorable outcomes following both endoscopic retrieval and surgical intervention, with low rates of recurrence and long-term sequelae [7]. However, challenges persist in optimizing diagnostic algorithms, therapeutic interventions, and preventive measures in patients at risk for FBA. Educational efforts targeting parents, caregivers, and healthcare providers are essential for raising awareness about FBA risk factors, signs, and preventive measures [8-10].

Future Directions

Future research endeavors should focus on prospective studies to elucidate optimal diagnostic algorithms, therapeutic interventions, and preventive measures in patients at risk for FBA. Multicenter collaborations and registry-based studies may facilitate the collection of large-scale data, enabling more robust analyses and generalizable findings. Additionally, advancements in imaging modalities such as virtual bronchoscopy and three-dimensional reconstruction techniques hold promise for improving the accuracy and efficiency of FBA diagnosis and localization [9]. Moreover, efforts to standardize protocols for FBA management and establish guidelines for multidisciplinary collaboration are warranted to ensure optimal patient care and outcomes.

Conclusion

In conclusion, this case series provides valuable insights into the epidemiology, clinical presentation, diagnostic methods, management strategies, and outcomes of patients with FBA. Early recognition and intervention are paramount to prevent complications and improve patient outcomes. Multidisciplinary collaboration among emergency physicians, otolaryngologists, pulmonologists, and thoracic surgeons is crucial for optimizing FBA management and minimizing associated morbidity and mortality. Future research endeavors should focus on prospective studies to elucidate optimal diagnostic algorithms, therapeutic interventions, and preventive measures in patients at risk for FBA.

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