ORIGINAL ARTICLE DOI: https://doi.org/10.18502/fem.v9i3.20016

Clinical and radiographic findings in children with foreign body aspiration: a 10-year cross-sectional study in a tertiary hospital

Kambiz Eftekhari[1], Hadi Majd[2], Monsour Mollaeian[3], Seyedmehdi Alehossein[4], Mohamadreza Tolou-ostadan-yazd[3], Masoumeh Ghasempour-alamdari [5], Alireza Shafiei[6]*

1. Pediatric Gastroenterology and Hepatology Research Center, Division of Gastroenterology, Department of Pediatrics, Bahrami Children's Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran.
2. Department of Pediatrics, Bahrami Children's Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran.
3. Department of Pediatric Surgery, Bahrami Children's Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran.
4. Division of Radiology, Bahrami Children's Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran.
5. Department of Pediatric pulmonology, Bahrami Children's Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran.
6. Division of Allergy and Clinical Immunology, Department of Pediatrics, Bahrami Children's Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran.

***Corresponding author:** Alireza Shafiei; **Email:** ar.shafii@gmail.com

Published online: 2025-07-07

Abstract: **Objective:** Aspiration of a foreign body in the airways of children is one of the important emergencies in children, which is associated with high mortality and morbidity if not diagnosed promptly or managed effectively. The aim of this study was to investigate the clinical and radiographic findings in children with foreign body aspiration.

Methods: In a large cross-sectional retrospective study at a tertiary hospital from 2009 to 2019, children with foreign body aspiration were evaluated. The required information (demographics, clinical examination findings, and results of radiological and bronchoscopy reports) was extracted from the medical records of the patients in the hospital archive.

Results: In this study, 330 patients were enrolled, 61.2% of whom were male. The mean age of the patients was 2.65±2.68 years. The average time interval from the onset of symptoms to the final diagnosis was 11.54 days. The most common location and type of aspirated foreign body were the right main bronchus (60%) and seeds (39.1%), respectively. Cough and decreased unilateral lung sounds were the most common clinical symptoms (91.5%) and physical findings (50.6%), respectively. The most common finding on chest X-ray was local emphysema (43%).

Conclusion: Foreign body aspiration can lead to irreparable injuries if it is not recognized and managed promptly. Aspiration of a foreign body can result in serious harm if not quickly diagnosed and properly managed. Clinical suspicion of aspiration and the management of these children are critical.

Keywords: Child; Foreign Bodies; Respiratory Aspiration

Cite this article as: Eftekhari K, Majd H, Mollaeian M, Alehossein S, Tolou-ostadan-yazd M, Ghasempour-alamdari M, et al. Clinical and radiographic findings in children with foreign body aspiration: a 10-year cross-sectional study in a tertiary hospital. Front Emerg Med. 2025;9(3):e20.

1. Introduction

Foreign body aspiration (FBA) is a serious and sometimes fatal event in children. Despite endoscopic advances in recent decades, about 7% of accidental deaths in children are caused by foreign body aspiration (1). The diagnosis of FBA is based on history, clinical examination, and a high level of suspicion (2). The symptoms of foreign body aspiration vary according to its location, type, size, degree of obstruction, and time interval between aspiration and referral (3). The most common symptoms include coughing, choking, wheezing, hoarseness, and cyanosis (4). The highest incidence of FBA occurs between one and three years of age and is more common in boys (5). In younger children, foods, especially nuts, are the most common aspirated foreign bodies, while in older children, non-food items, including toys, are more common (3). Although the location of FBA depends on age, in older children, it is more likely to be found in the lower part of the respiratory tract (6), but generally, most foreign bodies are located in the right bronchus (5,7). If FBA is

not recognized in a timely manner, it can lead to a number of complications, including pneumonia, atelectasis, bronchiectasis, lung abscess, empyema, hemoptysis, and eventually death (7). Delay in the diagnosis of FBA can result from neglecting the history, incomplete clinical examination, or poor clinical suspicion of the possibility of FBA (2,7).

Chest X-ray is one of the diagnostic modalities for FBA. Although a normal chest X-ray does not rule it out, abnormal radiographic findings may include unilateral hyperinflation, atelectasis, consolidation, pneumothorax, pneumomediastinum, and radiopaque foreign bodies. (2,7) Bronchoscopy is the method of choice for the diagnosis and treatment of aspirated foreign bodies (2,3,6).

The purpose of this study was to determine the findings from history, physical examination, and chest X-ray in children with foreign body aspiration admitted to Bahrami Children's Hospital, the only referral center for children in East Tehran, during the years 2010 to 2020.

2. Methods

2.1. Study design

This was a cross-sectional study.

2.2. Study population

The study was conducted at Bahrami Children's Hospital (Tehran, Iran) over a 10-year period (from April 2009 to January 2019) on children under 15 years of age who were hospitalized due to aspiration of a foreign body in the respiratory tract. To collect data, the medical records of all eligible patients were reviewed from the hospital archives.

2.3. Inclusion criteria

Children under 15 years with a final diagnosis of respiratory foreign body aspiration.

2.4. Exclusion criteria

Defects in patients' medical records, including history, chest X-ray, and bronchoscopy reports.

Demographic information (age, sex), clinical manifestations (cough, apnea, shortness of breath, cyanosis, etc.), physical examination findings, initial diagnosis, the time interval from the onset of symptoms to the final diagnosis, the type and location of the foreign body in the respiratory tract, and the chest X-ray report (local and generalized pulmonary hyperairation, atelectasis, and pulmonary infiltration) were collected from the patients' medical records available in the Bahrami Children's Hospital archive and recorded in the prepared checklist.

2.5. Ethical considerations

This survey was approved by the Ethics Committee of Tehran University of Medical Sciences (IR.TUMS.CHMC.REC.1400.014). Patient information remained confidential. The information collection checklists were coded and did not contain any identifying or personal information about the patients. This study was conducted in accordance with international principles governing clinical research and the Declaration of Helsinki.

2.6. Statistical analysis

The collected data were analyzed using SPSS statistical software (version 28.0, IBM, Armonk, New York). For statistical analysis, data are presented as the mean ± standard deviation (SD) for quantitative variables and summarized by frequency (percentage) for categorical variables.

3. Results

In this study, 330 medical records of patients with a final diagnosis of foreign body aspiration of the respiratory tract were evaluated. In terms of gender, 61.2% (n=202) were male and 38.8% (n=128) female. The mean age of the patients was 2.65± .68 (0.6 to 12) years. The highest frequency of foreign body aspiration occurred at the ages of one and two years, respectively (33% and 10.3%). The average time interval from the onset of symptoms to the final diagnosis was 11.54 (1-70) days. The highest frequency of final diagnoses occurred on the second, fifth, and first days, respectively (16.1%, 14.8%, and 13.3%).

In this study, the most common location of the aspirated foreign body was the right main bronchus (60%). The most commonly aspirated foreign body was seeds, with a frequency of 39.1%, followed by almonds and pistachios, respectively (10.3% and 8.8%). The details of the locations and types of aspirated foreign bodies are summarized in figures 1 and 2. The most common chief complaint of the patients was cough (57.2%), followed by choking, wheezing, and dyspnea (25.8%, 12.7%, and 4.3%), respectively. In terms of clinical symptoms, cough was the most prevalent symptom (91.5%). Cyanosis and choking were the next most common symptoms observed in patients. In the lung auscultation, unilateral sound reduction was the most common finding (50.6%). Details of patients' clinical symptoms and physical examinations are summarized in table 1.

The initial diagnosis during hospitalization in 84.8% of cases was foreign body aspiration. Respiratory tract infection and asthma were the next most common primary diagnoses (each 6.4%). Out of a total of 330 patients under study, 250 patients (75.7%) had abnormal radiographs, while the rest had normal radiographs. The most common abnormal finding in the chest X-rays of the patients was local emphysema in 142 cases (43%). The details are shown in table 2.

Diagnostic and therapeutic bronchoscopy was performed in all patients, with rigid bronchoscopy in 303 patients (93.3%) and fiber optic bronchoscopy in the rest.

4. Discussion

Foreign body aspiration is one of the most important medical emergencies in children, which can lead to significant

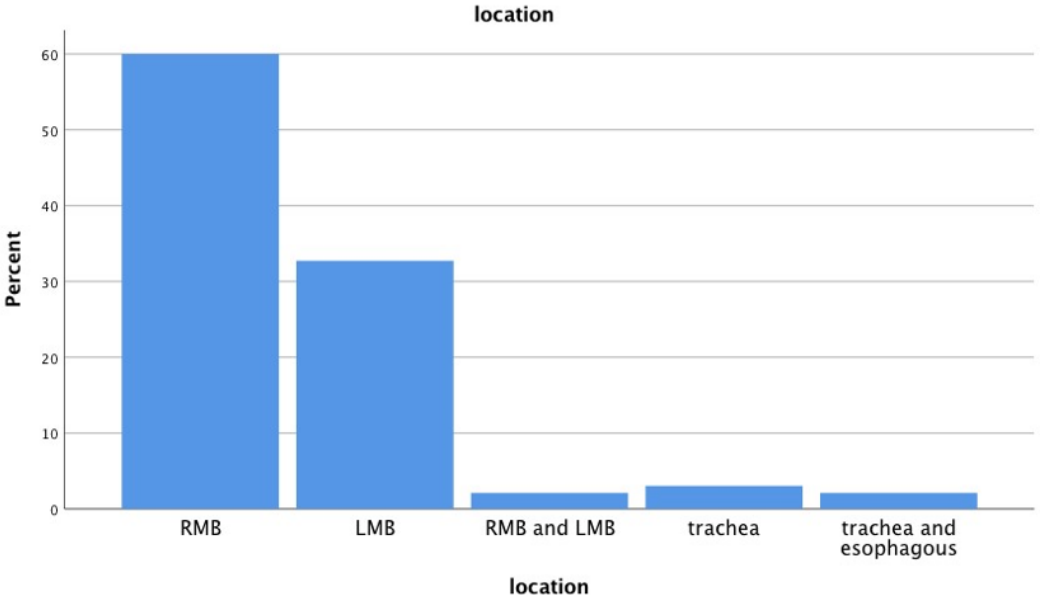

Figure 1 Details of the locations of aspirated foreign bodies

Table 1 Prevalence of clinical symptoms and physical examination findings in patients

Variables	Number	Percent
Clinical Symptoms		
Cough	302	91.5
Cyanosis	112	33.9
Chocking	85	25.8
Dyspnea	42	12.7
Respiratory distress	28	8.5
Tachypnea	7	2.1
Wheezing	203	61.5
Fever	34	10.3
Physical examination		
Decrease unilateral lung Sounds	167	50.6
Crackle	42	12.7
Ralls	27	8.2
Local wheezing	28	8.5
Diffuse wheezing	70	21.2
Stridor	14	4.2

Table 2 Radiologic findings of patients

Radiologic finding	Number	Percent
Local emphysema	142	43
Diffuse emphysema	57	17.3
Object in X-ray	45	13.6
Infiltration	41	12.4
Consolidation	22	6.6
Atelectasis	8	2.4
Collapse	8	2.4
Pneumomediastina	8	2.4
Mediastinal Shift	8	2.4
Normal	80	24.2

morbidity and mortality (1). In most cases, the diagnosis of foreign body aspiration is based on history and physical

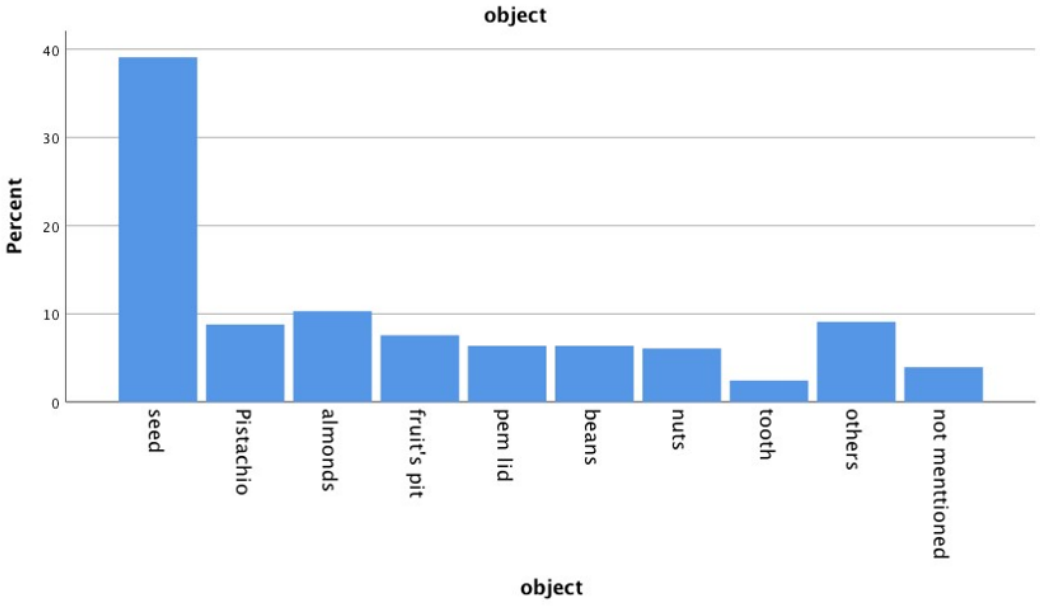

Figure 2 Details of the types of aspirated foreign bodies

examination (2). The presence of a foreign body in the airways for an extended period increases morbidity and mortality (1,6). Rigid bronchoscopy is the gold standard procedure for the removal of aspirated foreign bodies (8). Although bronchoscopy can reduce mortality by about 20%, approximately 7% of accidental deaths in childhood are still due to foreign body aspiration (1).

Similar to our study, most studies reported a higher incidence of foreign body aspiration in men (7,9-16), with only Mukherjee's study showing a higher incidence in women (17). To justify this issue, it can be mentioned that boys are probably more active and playful than girls (2). Additionally, in most studies, foreign body aspiration has been reported primarily among children aged one to three years (9-14,16,18), while only one study by Dar and colleagues reported an average age of four years (7). The higher frequency of aspiration in children under the age of 3 years may be attributed to several factors: the habit of putting objects in the mouth, which results from the child's oral recognition stage and the exploration of foreign objects, the absence of molar teeth for chewing food, running or crying with a full mouth, and poor coordination of swallowing and breathing muscles (19).

Aspiration of a foreign body can present with various clinical symptoms and physical examination findings. The most common clinical symptom among our patients was cough (91.5%), which was consistent with the findings of most studies (ranging between 33% and 84%) (9,11-12,15-16,18). Contrary to our study, some other studies reported that the most common clinical manifestation was choking (in the range of 51% to 100%) (7,10,13,17), while in our study, the prevalence of choking was 25.8%. This difference in the frequency of choking as a complaint among patients may be due to the absence of a caregiver present with the child during aspiration.

The most common finding in pulmonary auscultation of patients in some studies, including the recent study, was decreased unilateral pulmonary sounds (9,12,15). In Mindero et al.'s study, the most common finding in lung auscultation was rales (16).

The most common chest radiographic finding was localized emphysema in most studies, which was similar to our results (7,9,14,18). In Goyal's study, the most common chest radiographic finding was a normal X-ray (15), while in Mîndru's study, the most common finding was atelectasis (16). Similar to our study, in most studies, the most common site of aspirated foreign body entrapment was the right main bronchus (9,11,12,14,16-18). In Safari et al.'s study, the left main bronchus was the most common site of aspirated foreign body entrapment (13). The higher prevalence of aspirated foreign bodies in the right main bronchus is probably due to its alignment with the trachea (7).

The type of inhaled foreign body can vary depending on the age of the children. In younger children, food materials such as nuts are more common (3). Considering that most of the patients in our study were under three years of age, the most common foreign body aspiration (FBA) was seeds. Contrary to our results, where the most common aspirated food material was seeds, most other studies found peanuts to be the most common aspirated foreign object (9,11-12,14-15,18). Similarly, in the studies conducted by Dar and Safari, seeds were the most commonly aspirated foreign body (7,13). This difference in the type of aspirated substance may be attributed to the easy access of children to seeds in our country and some regions, as seeds are culturally and economically used as a common snack in these areas.

The average time interval from the onset of symptoms to the

final diagnosis in our study was about 11 days, while in Safari's study, more than half of the patients were diagnosed within 9 days (13). This delay in final diagnosis can be secondary to the lack of attention and precision from doctors regarding the possibility of foreign body aspiration in the differential diagnoses of children presenting with cough and wheezing.

5. Conclusion

Aspiration of foreign bodies is common in children and can lead to irreparable injuries, so the medical staff should receive the necessary training on recognizing the symptoms and managing children suspected of foreign body aspiration. Given the high importance of early diagnosis, prompt and appropriate management should be performed for these children. Additionally, proper training should be provided to families to prevent such incidents. Since the history of FBA may not be clear in children, there should be a high clinical suspicion of FBA in any child with acute respiratory symptoms.

6. Declarations

6.1. Acknowledgement

We thank all the children and their parents, the staff of the Archives and Radiology Department of Bahrami Children's Hospital, and Dr. Masoud Pourgholami for their cooperation in this study.

6.2. Authors' contribution

KE, HM, MM and AS conceived the premise of this study. KE, SA, HM, MG, and AS collected the data. KE, HM, MM, MG, SA, MT, and AS conducted the data analysis. KE, HM, MG, MM, SA, MT, and AS, wrote the first draft and final revision of the manuscript. All authors read and approved the final manuscript.

6.3. Conflict of interest

The authors declare that they have no competing interests.

6.4. Funding

There were no supporting source for the study.

References

1. Brkic F, Umihanic S, Altumbabic H, Ramas A, Salkic A, Umihanic S, et al. Death as a consequence of foreign body aspiration in children. Med Arch. 2018;72(3):220-23.
2. Molla YD, Mekonnen DC, Beza AD, Alemu HT, Selamawi AE. Foreign body aspiration in children at University of Gondar Comprehensive Specialized Hospital, a two year retrospective study. Heliyon. 2023;9(10):e21128.
3. Paladin I, Mizdrak I, Gabelica M, Golec Parčina N, Mimica I, Batinović F. Foreign bodies in pediatric otorhinolaryngology: a review. Pediatr. Rep. 2024;16(2):504-18.
4. Sumanth TJ, Bokare BD, Mahore DM, Ekhar VR, Sakhare PT, Gawarle SH. Management of tracheobronchial foreign bodies: a retrospective and prospective study. Indian J Otolaryngol Head Neck Surg. 2014;66(1):60-4.
5. Liang J, Hu J, Chang H, Gao Y, Luo H, Wang Z, et al. Tracheobronchial foreign bodies in children - a retrospective study of 2,000 cases in Northwestern China. Ther Clin Risk Manag. 2015;28(11):1291-5.
6. Johnson K, Linnaus M, Notrica D. Airway foreign bodies in pediatric patients: anatomic location of foreign body affects complications and outcomes. Pediatr Surg Int. 2017;33(1):59-64.
7. Dar MH, Patigaroo SA, Hussain T. Foreign body inhalation in children: clinical presentations and x-ray chest findings. Int J Med Sci Public Health. 2016;5:2274-78.
8. Azadmehr A, Makhsosi B, Mohammadi S, Yousefi M, Darvishi-Shani S. Rigid bronchoscopy in foreign bodies aspiration: value of the clinical and radiological findings. Iranian Journal of Neonatology. 2023;14(3):1-5
9. Aihole JS, Babu NM, Deepak J, Jadhav V. Airway foreign bodies: our six years' experience with 301 cases. Int J Contemp Pediatr. 2016;3:64-9.
10. Melpomeni B, Bledi N, Klevis T. Foreign bodies in airways in children in Albania. Ten years data. European Respiratory Journal . 2016;48(60):3148.
11. Budhiraja G, Singh H, Guram D, Pulkit, Kaur N. Foreign body aspiration in pediatric airway: a clinical study. Indian J Otolaryngol Head Neck Surg. 2022;74(3):6448-54.
12. Sai Akhil R, Priya TG, Behera BK, Biswal B, Swain SK, Rath D, et al. Clinico-radiological profile and outcome of airway foreign body aspiration in children: a single-center experience from a tertiary care center in Eastern India. Cureus. 2022;14(2):e22163.
13. Safari M, Manesh MR. Demographic and clinical findings in children undergoing bronchoscopy for foreign body aspiration. Ochsner J. 2016;16(2):120-4.
14. Dorterler ME, Kocaman OH, Gunendi T, Boleken ME. A single-center experience of pediatric foreign-body aspiration: a retrospective 4-year case series. Lung India. 2019;36(3):202-6.
15. Goyal S, Jain S, Rai G, Vishnu R, Kamath GS, Bishnoi AK, et al. Clinical variables responsible for the early and late diagnosis of foreign body aspiration in the pediatric age group. J Cardiothorac Surg. 2020;15(1):271.
16. Mîndru DE, Păduraru G, Rusu CD, Țarcă E, Azoicăi AN, Roșu ST, et al. Foreign body aspiration in children-retrospective study and management novelties. Medicina. 2023;59(6):1113.
17. Mukherjee M, Paul R. Foreign body aspiration: demographic trends and foreign bodies posing a risk. Indian J Otolaryngol Head Neck Surg. 2011;63(4):313-6.
18. Kang SH, Bae KS, Bang KW, Kim HS, Chun YH, Yoon

JS, et al. Foreign body aspiration in 48 children: clinical manifestations and outcomes. Allergy Asthma Respir Dis. 2016;4(2):107-13.
19. Sahadan DZ, Zainudin NM, Kassim A, Zahari Z, Mahadzir M, Daud CZ, et al. Case series of foreign body aspiration in Paediatric Institute, Hospital Kuala Lumpur. Med J Malaysia. 2011;66(5):484-6.