AUCTORES
Globalize your Research

Journal of Clinical Research and Reports
Volkan Sarper Erikci MD *

Open Access

Review Article

Airway Foreign Bodies in Children: A Review Article

Volkan Sarper Erikci MD *

* İzmir Faculty of Medicine, Department of Pediatric Surgery, İzmir Tepecik Health and Research Center, Sağlık Bilimleri University, İzmir, Turkey.

Corresponding Author: Volkan Sarper Erikci, Kazım Dirik Mah. Mustafa Kemal Cad. Hakkıbey apt. No: 45 D.10 35100 Bornova-İzmir, Turkey.

Received date: April 18, 2022; Accepted date: April 30, 2022; Published date: May 11, 2022

Citation: Volkan S. Erikci. (2022). Airway Foreign Bodies in Children: A Review Article. *J Clinical Research and Reports*, 11(3); DOI:10.31579/2690-1919/250

Abstract

Foreign body aspiration (FBA) in children represents a significant morbidity and even mortality producing sudden deaths. Regarded as a major public health issue, FBA may be the end result of aspiration of various organic and inorganic materials. Parental and public awareness including preventive measures is important in avoiding these injuries. The consequences of FBA may pose great challenge for both the children, their families together with clinicians dealing with these children. In this review article it is aimed to discuss the epidemiology, clinical presentations, diagnosis and treatment modalities of FBA in children under the light of relevant literature.

Key words: foreign body aspiration; children; treatment; FBA; epidemiology

Introduction

As a medical emergency foreign body aspiration (FBA) continues to result in high morbidity and mortality ranging from 10-20% worldwide [1]. Successful management of patients with FBA dates back to Gustav Killian in 1897 using bronchoscopic extraction and series of deaths in restaurants was first reported by Haugen in 1963 named as "café coronary" described as fatal upper airway obstruction that occurs in adults while swallowing large pieces of meat during laugh or chat [2, 3].

Children are prone to FBA because of absence of molar teeth, swallowing discoordination and their tendency to talk and play while eating [4, 5]. Bronchoscopy via rigid or flexible instruments is the gold standard of management in these cases. The aim of this study is to review FBA in children with regard to symptoms, history of presentation, physical and radiological findings, and methods of foreign body removal and outcome of these children with short and long-term sequale together with treatment modalities under the light of relevant literature.

Discussion

Epidemiology

It has been reported that FBA is a primary cause of accidental death in children under 12 months to 3 years of age [6, 7]. Despite increasing awareness of this problem, there is a rise in incidence of FBA in children. It has also been reported that in United States alone, FBA resulted in thousands of emergency room visits each year, producing 5% of all accidental deaths in children under the age of 4 [8]. In another report, the incidence of FBA was calculated to be 0.66 per 100.000 and during 2000 among emergency visits in USA, 17.000 were children with FBA under 14 years of age [9, 10].

FBA in children has a unique demography and most of the cases are below 3 years of age with a peek frequency in 1-2 years of age [6, 11]. Unlike adults, children do not have recall of FBA and the diagnosis usually depends on the history obtained from mother or care-giver. There is a male gender propendarence in most studies with large number of cases [12, 13]. It has been suggested that this finding may be due to their adventurous and impulsive behavior [14, 15]. Although there is no racial difference in children with FBA, a recent study questiones this and the incidence of FBA in Arab children was found to be higher than in their Jewish peers in Israel revealing a racial difference [16].

Type of inhaled foreign objects has wide variety with global variation. In general organic materials are more common than inorganic materials and peanuts are the most commonly aspirated organic materials [17-19]. In western countries, children usually aspirate organic materials while bones are common in Asia and China and seeds of watermelons, sunflowers, and pumpkins are more prevalent in Mediterranean countries like Egypt, Greece and Turkey [17, 20, 21]. Nature of inhaled foreign bodies has an impact in pathophysiology and on the degree of inflammation they produce. Organic materials may expand due to water absorption changing the airway obstruction from partial to total occlusion. On the other hand inorganic materials may occlude the airways causing upper airway obstruction [22, 23]. Organic materials may break up in to pieces which can be lodged in distant airways making removal difficult. It has been suggested that metallic objects cause minimal reaction while lipophilic materials stimulate intense chemo-inflammation in a response to fatty acid content [24].

The most common site of FBA is right bronchus as it is anatomically shorter and wider. The most common location of affected lung lobe is the right lower lobe because it is larger and more vertical. Bilateral lower lung

lobes are usually affected by aspiration during standing while alcoholics who aspirate in a prone position may have right upper lobe infiltrated commonly [25].

There is no standard classification system for FBA in children. According to degree of airway obstruction, there are two types; partial and complete obstruction. Logically complete obstruction has severe consequences compared to partial obstruction. With regard to origin of aspirated foreign body, these children may inhale internal or external materials. Endogenous sources include mucocoele and bronchial casts of plastic bronchitis while exogenous materials are numerous organic and inorganic items [26, 27].

Results

Clinical features

There is a wide range of symptoms and to reach a definitive diagnosis a high index of suspicion is required. Choking has the highest predictive factor of FBA and is commonly present in 75-90% of cases [28-30]. Persistent cough and difficulty in breathing are usually observed. Tracheal foreign bodies have usually a clinical triad including asthmatoid wheezing, audible slap from the obstructed trachea and palpable thud [31]. In another report, one third of all cases with FBA had classical triad of wheeze, cough, and unilateral decreased breath sounds [28, 32]. It has been suggested that in patients with persistent coughing and unresolved pneumonia, FBA must be ruled out. Careful history taking is also important for a definitive diagnosis of FBA. Delays in diagnosis of FBA may be up to 54% of presenting cases [33]. The reasons for this include unintentional aspiration by child unnoticed by parents, vague clinical history, lack of symptoms, hesitancy of clinician for getting a chest X-ray and late referral [33]. Differential diagnosis includes a long list of diseases and depends on foreign body location and is depicted in table 1 [34].

Laryngeal foreign bodies	Subglottic stenosis Epiglottitis
Tracheal foreign bodies	Croup Mass lesions of trachea and paratrachea Tracheomalacia Tracheal stenosis
Bronchial foreign bodies	Congenital cystic adenomatoid malformation (CCAM) Bronchial compression Plastic bronchitis
Bronchiole foreign bodies	Bronchiolitis Bronchiectasis Bronchiolitis obliterans Bronchiolitis obliterans with organizing pneumonia (BOOP)
Lobar obstructio	Asthma Atelectasis

Table 1: Differential diagnoses of foreign body aspiration.

Diagnosis

Diagnosis of FBA is a real dilemma and a high index of suspicion is important in diagnosing these patients. In a recent study, two out of the three was considered diagnostic and bronchoscopy was recommended: foal hyperinflation, witnessed choking crisis and leukocytosis [35]. In a scoring system created by Kadmon et al, parameters of FBA in children include age (10-24 months), history of presence of an object in a child's mouth followed by respiratory symptoms, signs of stridor, dyspnea or hyponia, unilateral abnormal breath sounds on auscultation, and abnormal tracheal radiogram and positive chest x-ray [36].

Chest radiograph is the first-line investigation in the diagnosis of FBA. Because most of inhaled foreign objects are radiolucent they can't be observed directly in x-rays and indirect findings of FBA should be searched for. These are unilateral lung hyperinflation, consolidation, collapse, atelectasis, tracheal or mediastinal shift [37]. Normal chest radiograph does not exclude FBA and it has been reported in previous studies that up to 50% of cases with FBA have normal chest radiographic findings [38, 39]. In unclear cases, computed tomography (CT) can be performed for diagnosis. Compared to bronchoscopy, CT is 100% sensitive, 66.7%specific, and has a positive predictive value of 93.3% and negative predictive value of 100% for detecting foreign body in the airway (40). Handicaps of CT include false positive results and radiation hazards associated with it [41-43].

Rigid bronchoscopic inspection is the gold standard in diagnosing these cases and has dual property including both defitive diagnosis and retrieval of lodged foreign object from the tracheobronchial tree. Flexible bronchoscopy is another option which is beneficial to assess distal airways for residual foreign body and for bronchial lavage in patients with negative bronchoscopy to obtain culture. Whether flexible or rigid, if there is high index of suspicion of FBA, bronchoscopy must be performed as fast as possible. It has been suggested that a negative bronchoscopy rate of 10-15% is acceptable [38]. Other treatment modalities if bronchoscopy is not helpful include invasive operations like tracheostomy, throracotomy, and bronchostomy [44, 45].

Inflammatory responses, localized edema and bronchospasm are the most common consequences of FBA [34]. Minor complications are arterial oxygen desaturation, bradycardia, and bronchospasm. Major complications include laryngeal edema, pneumothorax, and cardiac arrest. Other complications of FBA in children with long standing history include abscess formation, recurrent pneumonia, bronchiectasis and bronchial strictures.

In conclusion, FBA is a medical emergency that should be suspected in children with a history of choking. Prevention of FBA in children by parental and public education has paramount importance. First liners of medical providers should have a high index of suspicion of this clinical entity and early diagnosis and referral of these children to medical centers with a capability of performing urgent management reduces morbidity and mortality.

Conflicts of interest:

The author certifies that he has no affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials discussed in this manuscript.

Funding:

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Author contribution to the manuscript:

Idea/concept, design, control and processing, analysis and/or interpretation, literature review, writing the article, critical review, references and materials by Volkan Sarper Erikci.

References

1. Okonkwo OC, Simons A, Nichani J. (2016). North West ENT Research Collaborative. Pediatric airway foreign body-The human factors influencing patient safety in our hospitals. Int J Pediatr Otorhinolaryngol 2016; 91: 100-104.
2. Haugen RK. (1963). The café coronary: sudden deaths in restaurants. JAMA 1963; 186: 142-143.
3. Fleischer K. (1974). Erkennung und Entfernung Von. Bronchial-fremdkorpern-einstJetzt. TherGgegenw 1974; 113: 348-358.
4. Adjeso T, Damah MC, Murphy JP, Anyomih TTK. (2017). Foreign body aspiration in Northern Ghana: a review of pediatric patients. Int J Otolaryngol 2017: 1478795
5. Naragund AI, Mudhol RS, Harugop AS, Patil PH, Hajare PS, Metgudmath VV. (2014). Tracheo-bronchial foreign body aspiration in children: a one year descriptive study. Indian J Otolaryngol Head Neck Surg 2014; 66(Suppl 1): 180-185.
6. Foltran F, Ballali S, Rodriguez H, van As AB, Passali D, Gulati A, et al. Inhaled foreign bodies in children: a global perspective on their epidemiological, clinical, and preventive aspects. Pediatr Pulmonol 2013; 48(4): 344-351.
7. Erikçi V, Karaçay S, Arikan A. (2003). Foreign body aspiration: a four-years experience. Ulus Travma Acil Cerrahi Derg. 2003; 9(1):45–49
8. Nasir ZM, Subha ST. (2021). A five-year review on pediatric foreign body aspiration. Int Arch otorhinolaryngol 2021; 25(2): 193-199.
9. Hughes CA, Baroody FM, Marsh BR. (1996). Pediatric trachebronchial foreign bodies: Historical review from the Johns Hopkins Hospital. Ann Otol Rhinol Laryngol 1996; 105: 555-561.
10. Centres for Disease Control and Prevention (CDC). Nonfatal choking-related episodes among children. United States, 2001. MMWR Morb Mortal Wkly Rep 2002; 51:945.
11. Çiftçi AO, Bingöl-Koloğlu M, Şenocak ME, Tanyel FC, Büyükpamukçu N. Bronchoscopy for evaluation of foreign body aspiration in children. J Pediatr Surg 2003; 38(8):1170-1176.
12. Yadav SPS, Singh J, Aggarwal N, Goel A. (2007). Airway foreign bodies in children: experience of 132 cases. Singapore Med J 2007; 48(09):850-853.
13. Swanson KL, Prakash UB, Midthun DE, et al. (2002). Flexible bronchoscopic management of airway foreign bodies in children. Chest 2002; 121(05): 1695-1700.
14. Shivakumar AM, Naik AS, Prashanth KB, Shetty KD, Praveen DS. (2003). Tracheobronchial foreign bodies. Indian J Pediatr 2003; 70: 793-797.
15. Tan HK, Brown K, McGill T, Kenna MA, Lund DP, Healy GB. (2000). Airway foreign bodies (FB): a 10-year review. Int J Pediatr Otorhinolaryngol 2000; 56(02):91-99.
16. Shlizerman L, Ashkenazi D, Mazzawi S, Harefuah RY. (2006). Foreign body aspiration in children: ten-years experience at the Ha'Emek Medical Center. Harefuah 2006; 145: 569-571.
17. Baharloo F, Veyckemans F, Francis C, Biettlot MP, Rodenstein DO. (1999). Tracheobronchial foreign bodies: presentation and management in children and adults. Chest 1999; 115: 1357-1362.
18. Kitcher ED. (2009). Foreign body inhalation: a review of patients at the Korle Bu Teaching Hospital, Accra, Ghana. West Afr J Med 2009; 28(06): 368-370.
19. Parameswaran N, Das S, Biswal N. (2018). Respiratory morbidity following foreign body aspiration among South Indian children: a descripitive study. Cureus 2018; 10(11):e3629.
20. Patel S, Kazeroonl EA. (2001). Case 31: foreign body aspiration-chicken vertebra. Radiol 2001; 218: 523-525.
21. Vijayasekaran D, Sambandam AP, Gowrishankar NC. (2004). Acute plastic bronchitis. Indian Paediatr 2004; 41:1257-1259.
22. Yetim TD, Bayaroğulları H, Arıca V, Akçora B, Arıca SG, Tutanç M. (2012). Foreign body aspiration in children: analysis of 42 cases. J Pulm Respir Med 2012; 1(03):61-67.
23. Fraga Adem, Reis MC, Zambon MP, Toro IC, Ribeiro JD, Baracat EC. (2008). Foreign body aspiration in children: clinical aspects, radiological aspects and bronchoscopic treatment. J Bras Pneumol 2008; 34(02):74-82.
24. Ganong WF. (2005). Review of Medical Physiology. 22th Ed. London: McGraw-Hill; 2005; 678.
25. Goh P, Lim E, Teo D, et al. Challenges in diagnosing foreign body aspiration in children. Cureus 14(1):e21519.
26. El-Munshid HA. (2000). Gastrointestinal physiology. In: Sukkar MY, El-Munshid HA, Ardawi MSM. Concise Human Physiology. 2nd Ed. Oxford: Blackwell, 2000; 159.
27. Park JY, Elshami AA, Kang DS, Jung TH. (1996). Plastic bronchitis. Eur Respir J 1996; 9: 612-614.
28. Mitchell CA, Kreiger P, Goff C, Shah UK. (2015). Pediatric foreign body aspiration: a nidus for Aspergillus colonization. Int J Pediatr Otorhinolaryngol 2015; 79(06):938-940.
29. Even L, Heno N, Talmon Y, Samet E, Zonis K, Kugelman A. (2005). Diagnostic evaluation of foreign body aspiration in children: a prospective study. J Pediatr Surg 2005; 40(07):1122-1127.
30. Eren S, Balcı AE, Dikici B, Doblan M, Eren MN. (2003). Foreign body aspiration in children: experience of 1160 cases. Ann Trop Paediatr 2003; 23(01):31-37.
31. Jackson C, Jackson CL. (1936). Diseases of the air and food passages of foreign body origin. 1st Ed. Philadelphia, PA: Elsevier Saunders; 1936.
32. Midulla F, Guidi R, Barbato A, et al. (2005). Foreign body aspiration in children. Pediatr Int 2005; 47(06):663-638.
33. Goyal S, Jain S, Rai G, Vishnu R, Kamath GS, Bishnoi AK, Gaude Y, Kumara V, Joshi H, Reddy R. (2020). Clinical variables responsible for early and late diagnosis of foreign body aspiration in pediatrics age group. J Cardiothorac Surg 2020: 15:(271):1-6.
34. Salih AM, Alfaki M, Alam-Elhuda DM. (2016). Airway foreign bodies: a critical review for a common pediatric emergency. World J Emerg Med 2016; 7(1):5-12.
35. Heyer CM, Bollmeier ME, Rossler L, Nuesslein TG, Stephan V, Bauer TT, et al. (2006). Evaluation of clinical, radiologic, and laboratory prebronchoscopy findings in children with suspected foreign body aspiration. J Pediatr Surg 2006; 41: 1882-1888.
36. Kadmon G, Stern Y, Bron-Harlev E, Nahum E, Battat E, Schonfeld T. (2008). Computerized scoring system for the diagnosis of foreign boy aspiration in children. Ann Otol Rhinol Laryngol 2008; 117: 839-843.

37. Kaur K, Sonkhya N, Bapna AS. (2002). Foreign bodies in the trachebronchial tree: a prospective study of fifty cases. Indian J Otolaryngol Head Neck Surg 2002; 54(01): 30-34.
38. Rovin JD, Rodgers BM. Pediatric foreign body aspiration. Pediatr Rev 2000; 21(03): 86-90.
39. Sultan TA, van As AB. (2016). Review of tracheobronchial foreign body aspiration in the South African paediatric age group. J Thorac Dis 2016; 8(12):3787-3796.
40. Srivastava G. (2010). Airway foreign bodies in children. Clin Pediatr Emerg Med 2010; 11(01): 30-34.
41. Haliloğlu M, Çiftçi AO, Oto A, Gümüş B, Tanyel FC, Şenocak M, et al. (2003). CT virtual bronchoscopy in the evaluation of children with suspected foreign body aspiration. Eur J Radiol 2003; 48(2):188-192.
42. Hong SJ, Goo HW, Roh JL. (2008). Utility of spiral and cine CT scans in pediatric patients suspected of aspirating radiolucent foreign bodies. Otolaryngol Head Neck Surg 2008; 138(5): 576-580.
43. Koşucu P, Ahmetoğlu A, Koramaz I, Orhan F, Özdemir O, Dinç H, et al. (2004). Low-dose MDCT and virtual bronchoscopy in pediatric patients with foreign body aspiration. Am J Roentgenol 2004; 183(6):1771-1777.
44. Ülkü R, Önen A, Onat S, Özçelik C. (2005). The value of surgical approaches for aspirated pen caps. J Pediatr Surg 2005; 40:1780-1783.
45. Zhijun C, Fugao Z, Niankai Z, Jingjing C. (2008). Therapeutic experience from 1420 patients with pediatric tracheobronchial foreign body. J Pediatr Surg 2008; 43:718-721.

DOI: 10.31579/2690-1919/250