

Original paper

Foreign Body Aspiration in Children

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Abstract

Background: foreign bodies aspiration in children is a common emergency condition especially in less than 3 years old, comprising an important proportion of accidental deaths. Usually, there is a suggestive history of choking. The evolution of foreign body aspiration can lead to variable degrees of respiratory distress, serious respiratory complications, and even death. Early rigid bronchoscopy is a very effective procedure for definite diagnosis and removal of aspirated foreign body with fewer complications.

Aim of study: To discuss causes and types of foreign body aspiration and effectiveness of bronchoscopy in children.

Patients and Method: In Al-Hussein Medical City Hospital, bronchoscopy had been performed to 254 patients with the diagnosis of foreign body aspiration (from 2005 to 2012). Of which, 152 (59.85%) were males and 102 (40.15%) were females. Their ages ranged from 6 months to 10 years. Diagnosis had been established depending on history, physical examination, radiological studies and bronchoscopy.

Results & Discussion: Foreign bodies (FBs) were removed by rigid bronchoscope. The sites of FBs were distributed in the following pattern: at the right main bronchus in 129 (50.79%) patients, at the left main bronchus in 55 (21.65%) patients, at the trachea in 38 (14.96%) patients, at the larynx in 16(6.3%) patients, and both bronchi in 4 (1.57%) patients. No foreign body could be found in 12 (4.73%) cases. The majority of the FBs were seeds 155 (61.02%). Pneumonia occurred in only 8(3.14%) patients.

Foreign body aspiration is frequently encountered in pediatric practice. the condition is often not diagnosed immediately because there are no specific clinical manifestations. the ages 1 to 3 years were predominantly affected. The most common foreign body inhaled, Symptoms, most frequent age, and type of inhaled foreign body are different from region to region across the world. Foreign body aspiration was misdiagnosed by physician as pneumonia, asthma, bronchiectasis and bronchiolitis. Their definite diagnosis and treatment were provided by bronchoscopy, which was resorted to after unresponsiveness to previous treatment.

Conclusion: Rigid bronchoscopy is very effective procedure to remove aspirated FBs with fewer complications.

Keywords: foreign body aspiration, choking, bronchoscopy.

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Introduction

FBs aspiration in children is a common emergency condition especially in less than 3 years old, comprising an important proportion of accidental deaths⁽¹⁾. Delay in diagnosis and, consequently, a series of chronic pulmonary pathologic conditions may occur in the cases without acute respiratory failure⁽²⁾. It is estimated that almost 600 children under 15 years old died per year in the USA following aspiration of FBs⁽³⁾. The main symptoms associated with aspiration are suffocation, cough, stridor, excessive sputum production, cyanosis or difficulty in breathing. These symptoms develop immediately after the aspiration^(4,5). If the event is noticed immediately, the child is taken to the hospital for bronchoscopy. If the event is unnoticed and there are no indicative clinical or radiological findings, the patient can be hospitalized for bronchitis, bronchial asthma or in neglected cases for pneumonitis, with dangerous consequences for the health and life of the patient due to the delayed diagnosis⁽⁶⁾.

The majority of aspirated objects are organic in nature, mainly food⁽⁷⁾. Peanuts are the most commonly FBs identified by different studies^(8,11), but some mention watermelon and sunflower seeds as the predominant FBs^(9,10). This variation in types of FBs materials can be explained by cultural, regional and feeding habit differences⁽¹²⁾. The high incidence of

aspirated seeds is related to the absence of molar teeth development between 2 and 3 years of age. This results in an inadequate chewing process, therefore the offering of chunks of food and seeds of any kind to this age group should be avoided⁽¹³⁾. It is also strongly recommended that younger children should not be allowed to play with small plastic or metallic objects. Surprisingly, however, plastic toys are not a frequent cause of FBA in series from developing countries but they represent more than 10% of those identified in the developed world^(14,15).

Management of aspirated FBs depends on the site of impaction. Laryngeal and subglottic FBs need urgent intervention in the form of tracheostomy or urgent bronchoscopy, whereas foreign bodies in the right or left main bronchus cause comparatively less airway problem⁽¹⁶⁾. Rigid bronchoscopy is the recommended procedure in children with suspected aspirated FBs⁽¹⁷⁾.

Patients and method

In Al-Hussein Medical City Hospital, 254 cases with the diagnosis of FBA were evaluated and treated from January 2005 to November 2012. Equal number of children came from urban and rural communities, 152 (59.85%) were male while 102 (40.15%) were female. The average age was 2.6 years (range 6 months-10 years).



Plain chest radiography (CXR) was done to 232 (91,34%) patients, the remaining 22 (8.66%) patients were underwent immediate bronchoscopy because of acute respiratory distress at presentation. Computed tomography was used in some cases of suspected FBA and to determine the presence of lung complications due to FB in late period. FBs were found during bronchoscopy in 242 (95,27%) patients with the history of FB inhalation. the remaining 12 patients had no FB found during bronchoscopy. A total of 262 bronchoscopies for 254 patients using a rigid bronchoscope in appropriate size and under general anesthesia were done because bronchoscopy was repeated once or twice in 6(2.36%) cases, for reasons such as the physical and radiological examinations after bronchoscopy suggestive of the ongoing presence of a foreign body. Postoperatively we observed moderate to severe laryngospasm in 27(10.62%) patients, prolonged O2 therapy was necessary in 10(3.94%) patients, 8 (3.14%) patients developed pneumonia postoperatively and one (0.39%) patient need tracheostomy. One (0.39%) patient who was hypoxic at admission and required immediate bronchoscopy developed cardiac

arrest at induction of anesthesia before any surgical attempt. After resuscitation and stabilization of the patient, the FB which filled most of tracheal lumen was extracted, this patient developed neurological sequels. One (0.39%) patient died due to brain anoxia. Antibiotics were administered for 5-7 days to the patients who aspirated vegetable materials and developed pneumonia. If any specific microorganism was isolated from bronchial lavage taken at the time of bronchoscopy, the treatment continued with appropriate antibiotics. Patients were categorized into two groups according to the elapsed time of referral; those that were reported within first 24 hours were termed 'early', and those received after 24 hours or more were termed 'late'.

Results

The age distribution of study includes 46 (18.11%) patients less than 1 year of age, 140 (55.12%) patients were 1 to 3 years, 51(20.08%) patients were 3 to 6 years old and 17 (6.69%) patients were more than 6 years old. The maximum incidences occurred at the age of 1-3 years, as shown in table 1.

Table 1 Age distribution of patients

	No. of patients	Percentage (%)
< 1 year	46	18.11%
1-3years	140	55.12%
3-6years	51	20.08%
>6years	17	6.69%
Total	254	100

Under general anesthesia, all the patients were scoped using rigid bronchoscope , seeds was retrieved in 155 (61.02%) patients, food materials in 40 (15.74%) patients, peanuts in 18 (7.09%) patients, bones in 10(3.94%)

patients, pins in 8 (3.14%) patients followed by other FBs like plastic objects and parts of toys with various number and percentage, as shown in table 2.

Table 2 Foreign body types.

Foreign body	No. of patients	Percentage (%)
Seed	155	61.02%
Food material	40	15.74%
Peanut	18	7.09%
Bone	10	3.94%
Pin	8	3.14%
Plastic object	3	1.18%
Stone	2	0.79%
Bead	1	0.39%
Other	5	1.98%
None	12	4.73%
Total	254	100

Radiological examination showed obstructive emphysema in 58 (22.83%) patients while opaque FBs in 22 (8.66%) patients, unilateral atelectasis in 18 (7.09%) patients, bronchiectasis in 17 (6.69%) patients and 10(3.94%) patients showed lobar pneumonia on chest x-ray. The rest 107(42.13%) patients had normal chest X-ray and in 22 (8.66) patients no time available for doing chest X-ray as shown in table 3.

The most common site of foreign body impaction was right main bronchus in 129 (50.79%) patients followed by left main bronchus in 55 (21.65%) patients, trachea in 38 (14.96%) patients, larynx in 16 (6.3%) patients and both bronchi in 4 (1.57%) patients. No foreign body could be found in 12 (4.73%) cases, as shown in table 4.

Table 3.Radiological finding

Radiological finding	No. of patients	Percentage (%)
Obstructive emphysema	58	22.83%
Opaque FB	22	8.66%
Unilateral atelectasis	18	7.09%
Bronchiectasis	17	6.69%
Lobar pneumonia	10	3.94%
Normal CXR	107	42.13%
No CXR	22	8.66%
Total	254	100

Table 4 sites of impacted Foreign bodies.

sites of impacted Foreign bodies.	No. of patients	Percentage (%)
right main bronchus	129	50.79%
left main bronchus	55	21.65%
Trachea	38	14.96%
Larynx	16	6.3%
both bronchi	4	1.57%
No foreign body	12	4.73%
Total	254	100

One hundred nine (42.91%) patients were categorized into the early group and 145 (57.09%) patients into the late group. The duration of impaction of

foreign body ranged from 1 hour to more than 3 month, the median duration of the symptoms prior to admission was 72 hours. There was a

delay of more than 4 weeks in 6 (2.36%) cases, the maximum gap

between the onset and referral being 96 days as shown in table 5.

Table 5 Duration of impaction of foreign body

Length of time	No. of patients	Percentage (%)
< 1 day	109	42.91%
1-7 days	125	49.21%
1-4 week	14	5.52%
>4 week	6	2.36%
Total	252	100

In 206 (81.12%) patients recovery was un-eventful except mild laryngeal edema which was treated by steroids and humidified air, 27 (10.63%) patients complicated by laryngospasm, 10 (3.94%) patients need prolonged O₂ therapy, 8 (3.14%) patients developed pneumonia post operatively, one (0.39%) patient need tracheostomy prior to bronchoscopy, one (0.39%) patient end with

neurological sequelae due to delay referral. One (0.39%) patient died due to brain anoxia. Most of patients were discharged from hospital on the same day.

Two hundred thirteen (83.58%) patients presented with choking, 200 (78.74%) patients had paroxysmal cough and 193 (75.98%) patients presented with tachypnea as shown in table 6.

Table 6. Presenting clinical features and corresponding patient numbers and percentage with foreign body aspiration.

Symptoms	Referral groups	
	No. of patient	(Percentage)
Choking	213	83.58%
Cough	200	78.74%
Tachypnea	193	75.98%
Wheezing	180	70.86%
Decrease air entry	170	66.92%
Fever	73	28.74%
Stridor	33	12.99%
Cyanotic episode	25	9.84%
Syncope	15	5.90%

Discussion

Foreign body aspiration is frequently encountered in pediatric practice; however, the condition is often not diagnosed immediately because there are no specific clinical manifestations. Usually, there is a suggestive history of choking, although the classic clinical presentation, with coughing, wheezing, and diminished air inflow, is seen in less than 40% of the patients; other symptoms include cyanosis, fever, and stridor. Sometimes, FBA can be completely asymptomatic. The

evolution of FBA can lead to variable degrees of respiratory distress, atelectasis, chronic coughing, recurrent pneumonia, and even death^(18,19). Previous reports indicate that male gender is present in 60—66% of cases and children in the first two years of life are predominantly affected^(20,21). In this study the frequency of FBA in male was 59.85% and the ages 1 to 3 years were predominantly affected. The most common foreign body inhaled, Symptoms, most frequent age, and type of inhaled foreign body are

different from region to region across the world.

Table7 Presenting corresponding patient numbers with foreign body type and age

Age groups	Foreign body type No. (Percentage)										
	Seed	Food material	Peanut	Bone	pin	Plastic object	Stone	Bead	Other	Non	Total
< 1	28(11.02%)	16(6.29%)	1(0.39%)	0	1(0.39%)	0	0	0	0	0	46
1 -3	96(37.79%)	20(7.87%)	12(4.72%)	6(2.36%)	3(1.18%)	1(0.39%)	01(0.39%)	1(0.39%)	0	0	140
3 -6	24(9.44%)	3(1.18%)	5(1.96%)	4(1.57%)	3(1.18%)	1(0.39%)	1(0.39%)	0	4(1.57%)	6(2.36%)	51
>6	7(2.75%)	1(0.39%)	0	0	1(0.39%)	1(0.39%)	0	0	01(0.39%)	6(2.36%)	17
Total 1 (n=254)	155(61.02%)	40(15.74%)	18(7.08%)	10(3.93%)	8(3.14%)	3(1.18%)	2(0.78%)	1(0.39%)	5(1.96%)	12(4.72%)	254

160 (63%) of cases were evaluated by a physician before referring to our unit and about 94 (37%) of cases were misdiagnosed and maltreated with different drug without any improvement and this lead to unsmooth postoperative recovery. Foreign body aspiration was misdiagnosed by physician as pneumonia in 25%, asthma in 7%, and bronchiectasis in 2% and bronchiolitis in 3%. Their definite diagnosis and treatment were provided by bronchoscopy, which was resorted to after unresponsiveness to previous treatment. Factors, which may delay the diagnosis include:

- (1) Paternal negligence and wrong diagnosis by the doctor.
- (2) Lack of symptoms, particularly after the acute initial phase of dyspnea.
- (3) Diverse clinical features due to aspiration of FB.

The delayed diagnosis rate in our locality was high compared to rates of 17% and 23% reported in other Asian studies^(22,23). Chest radiograph is important tool in diagnosis of FB aspiration. Since the most common

aspirated objects are organic and thus radiolucent, their presence is usually established by the indirect signs of atelectasis or air trapping due to partial obstruction. Emphysema or hyperinflation was the commonest finding in this study. Other studies had also reported high frequency of this finding^(11,14). It need to be pointed out that chest radiograph is normal in as many as 15-45% of cases^(6,9). Radiographs were normal in 42% of our cases. The presence of X-ray findings is related to size, type, shape & location of FB & pattern & length of bronchial obstruction.

In FBA, bronchiectasis and pulmonary damage can occur as complications of the late period⁽²²⁾. Bronchoscopy in children under 12 months requires skills because technical difficulties due to small instrumentation and laryngospasm commonly occur when compared to older children. Rough contact of the bronchoscope or forceps with the bronchial wall, and the prolongation of bronchoscopy can be considered to be factors which

contribute to spasm. It has been reported that a bronchoscope with appropriate diameter should be chosen and the procedure should be limited to 20 min in order to avoid possible subglottic and laryngeal edema and bronchospasm after bronchoscopy⁽²³⁾. Previous reports indicate that male gender is present in 60—66% of cases and children in the first two year of life are predominantly affected^(20,21). The data of this study show the incidence, gender, and age of patients with foreign body aspiration were nearly consistent with the literatures. The most common age at risk found less than 3 years old in most reported papers that was in agreement with our study^(22,26).

Aspirated foreign bodies can be classified into two categories, organic and inorganic. Most of the aspirated foreign bodies are organic materials, such as watermelon and sunflower seeds in children, the most common type of inorganic aspirated substances in children are, pins, nails, small parts of various toys, and small parts of school equipment such as pen caps⁽²⁴⁾. These results were changed from study to study & from country to country, so in some Asian countries such as India⁽²⁵⁾, China⁽²⁶⁾, and Turkey⁽²⁷⁾, the most common were organic type include peanut, ground and dried nuts, while in European countries such as Italy⁽²⁸⁾ and Kosovo⁽²⁹⁾ the most common were organic type include dried nuts as well as inorganic type in some countries like Spain⁽³⁰⁾. In this study the most common type of FB were seeds (sunflower and watermelon seeds) and the cause mainly due to availability and low price of this substances.

Pneumonia, the most frequent complication after bronchoscopy in the literature⁽¹⁹⁾, occurs in only 8 (3.14%) patients out of our cases because of the antibiotics. In this study, the high

incidence of post-operative laryngospasm and prolonged O₂ therapy were due to delay in referral of patients and the bad habit of inserting fingers in the mouth of a child aiming to remove FB, these complications are low in other studies^(8,12). FBA, one of the leading causes of accidental children deaths at home, does rarely cause deaths after the victim is safely brought to hospital. FBA not always can be identified using the existing diagnostic methods and, if the methods of removal are appropriate for the type of the FB is used, favorable outcomes with lower mortality and morbidity rates will be noticed.

Almost 42.91% of our patients were diagnosed as having FBA during 24 hours after onset of symptoms. Young children below the age of 3 years are particularly at risk of aspiration, as demonstrated in our study as well as others^(27,28).

Conclusion

Early rigid bronchoscopy is a very effective procedure for aspirated foreign body removal with fewer complications.

Recommendations

- 1- Child or infant who satisfying the following criteria should be subjected to bronchoscopy:
 - A. History of definite or suspected FB aspiration.
 - B. Features of FB aspiration, e.g., choking, wheezing, stridor & cough.
 - C. Recurrent chest infections with no apparent cause.
 - D. CXR suggestive of FB aspiration.
- 2- Guidance should be provided to parents and families when their children are 6 months old. Infants at this age begin to develop the fine motor skills needed to pick up

and swallow small objects. Because seeds and food items such as peanuts are commonly aspirated, advice parents not to offer such substances until their child is old enough to chew them properly, also advice the parent to feed their child only when he is sitting upright and to discourage the child from running, playing or laughing while eating. Remind parents to place all small objects such as pins, nails and small parts of toys safely out reach of children.

References

1. Rovin DJ, Rodgers BM. Pediatric foreign body aspiration. *Pediatr Rev* 2000;21:86-9.
2. Vitro C, Allessnadra MP: Foreign body in children airway. *Pneumologia* 2003;29:45-53
3. Roda J, Nobre S, Pires J, Estêvão MH, Félix M. Foreign bodies in the airway: A quarter of a century's experience. *Rev Port Pneumol.* 2008;14:787-802
4. Rahbarimanesh A, Noroozi E, Molaian M, Salamati P. Foreign Body Aspiration: A five-year Report in a Children's Hospital. *Iranian Journal of Pediatrics.* 2008;18:191-192
5. Yadav S P S, Singh J, Aggarwal N, Goel A. Airway foreign bodies in children: experience of 132 cases. *Singapore Med J.* 2007;48:850
6. Kiyani G, Gocmen B, Tugtepe H, Karakoc F, Dagli E, Dagli TE. Foreign body aspiration in children: The value of diagnostic criteria. *Int J PediatrOtorhinolaryngol.* 2009;73:963-7
7. Tomaske M, Gerber AC, Stocker S, Weiss M. Tracheobronchial foreign body aspiration in children - diagnostic value of symptoms and signs. *Swiss Med Wkly.* 2006Aug19;136:533-8
8. Karakoc F, Cakir E, Ersu R, Uyan ZS, Colak B, Karadag B, Kiyani G, Dagli T, Dagli E. Late diagnosis of foreign body aspiration in children with chronic respiratory symptoms. *Int J PediatrOtorhinolaryngol.* 2007Feb;71:241-6
9. Midulla F, Guidi R, Barbato A, Capocaccia P, Forenza N, Marsiglia G, Pifferi M, Moretti C, Bonci E, De Benedictis FM. Foreign body aspiration in children. *Pediatr Int.* 2005Dec;4:663-8
10. Wiseman NE. The diagnosis of foreign body aspiration in childhood. *J PediatrSurg* 1984;19:531-5
11. Raos M, Klancir SB, Dodig S, Koncul I. Foreign bodies in the airways in children. *LijecVjesn.* 2000Mar;122:66-9
12. TsolovTs, Melnicharov M, Perinovska P, Krutilin F. Foreign bodies in the upper airways of children - problems relating to diagnosis and treatment. *Khirurgiia (Sofia).* 1999;55:33-4
13. Emir H, Tekant G, Beşik C, Eliçevik M, Senyüz OF, Büyükkünel C, Sarimurat N, Yeker D. Bronchoscopic removal of tracheobroncheal foreign bodies: value of patient history and timing. *PediatrSurg Int.* 2001Mar;17:85-7
14. Wolach B, Raz A, Weinberg J, Mikulski Y, Ben Ari J, Sadan N. Aspirated foreign body in the respiratory tract of children :11 years experience. *Int J PediatrOtorhinolaryngol* 1994;30:1-10
15. Skoulakis CE, Doxas PG, Papadakis CE, Proimos E, Christodoulou P, Bizakis JG, Velegrakis GA, Mamoulakis D, Helidonis ES. Bronchoscopy for foreign body removal in children. A review and analysis of 210 cases. *Int J PediatrOtorhinolaryngol.* 2000;30;53:143-8
16. Zaupa P, Saxena AK, Barounig A, Hollwarth ME. Management strategies in foreign-body aspiration. *Indian J Pediatr.* 2009;76:157-61
17. Dunn GR, Wardrop P, Lo S, Cowan DL. Management of suspected foreign body aspiration in children. *ClinOtolaryngol Allied Sci.* 2004;29:286
18. Osman EZ, Webb CJ, Clarke RW. Management of suspected foreign body aspiration in children. *ClinOtolaryngol Allied Sci.* 2003Jun;28:276
19. Dunn GR, Wardrop P, Lo S, Cowan DL. Management of suspected foreign body aspiration in children. *ClinOtolaryngol Allied Sci.* 2002;27:384-6
20. Martinot A, Closset M, Marquette CH, Hue V, Deschildre A, Ramon P, Remy J, Leclerc F. Indications for flexible versus rigid bronchoscopy in children with suspected foreign-body aspiration. *Am J RespirCrit Care Med.* 1997May;155:1676-9
21. Lima JA, Fischer GB. Foreign body aspiration in children. *PaediatrRespir Rev.* 2002Dec;3:303-7
22. Gandhi R, Jain A, Agarwal R, Vajifdar H. Tracheobronchial Foreign Bodies- A seven

- years review. *J Anesth Clin Pharmacology*. 2007;23:69-74
23. Tang LF, Xu YC, Wang YS, Wang CF, Zhu GH, Bao XE, Lu MP, Chen LX, Chen ZM. Airway foreign body removal by flexible bronchoscopy: experience with 1027 children during 2000-2008. *World J Pediatr*. 2009Aug;5:191-5
24. Goktas O, Snidero S, Jahnke V, Passali D, Gregori D. Foreign Body Aspiration in Children: Field Report of a German Hospital. *Pediatr Int*. 2009 [Epub ahead of print]
25. Chik KK, Miu TY, Chan CW. Foreign body aspiration in Hong Kong Chinese children. *Hong Kong Med J*. 2009Feb;15:6-11
26. Ramos MB, Fernandez-Villar A, Rivo JE, Leiro V, Garcia-Fontan E, Botana MI, Torres ML, Canizares MA. Extraction of airway foreign bodies in adults: experience from 1987-2008. *Interact Cardiovasc Thorac Surg*. 2009Sep;9:402-5
27. Borton EM, Brick WG, Riggs W. Tracheobronchial foreign body aspiration in children. *South Med J* 1998;89:195-8
28. Metrangolo S, Monetti C, Meneghini L, Zadra N, Giusti F. Eight Years' Experience With Foreign-Body Aspiration in Children: What Is Really Important for a Timely Diagnosis?. *J Pediatr Surg*. 1999;34:1229-31
29. Latifi X, Mustafa A, Hysenaj Q. Rigid tracheobronchoscopy in the management of airway foreign bodies: 10 years' experience in Kosovo. *Int J Pediatr Otorhinolaryngol*. 2006;70:2055-9
30. Kalyanappagol VT, Kulkarni NH, Bidri LH. Management of tracheobronchial foreign body aspirations in paediatric age group - a 10 year retrospective analysis. *Indian J Anaesth*. 2007;51:27- 23