

# Airway Foreign Bodies

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Foreign body aspiration (FBA) is a potentially life-threatening event, more common in children than in adults. In the year 2001 in Italy, inhaled FB accounted for 30 deaths from respiratory obstruction in children [1]. The signs and symptoms of FBA vary according to the age of the subject, the type of object aspirated, the location of the object, and the elapsed time since the event. The removal procedure is safe and rewarding if it is carried out with the right instruments and by experienced physicians in specialised centres.

## Epidemiology

Children younger than three years old, with the peak incidence between one and two years of age, account for the majority of cases [1-10]. At this age, children are apt to explore their world via the oral route, but they do not yet have molars to chew food adequately. Nearly all case series report a male predominance, with a sex ratio ranging from 1.5:1 to 2.4:1 [5-7, 10, 11].

In adults, neurologic disorders, loss of consciousness, and alcohol or sedative abuse predispose to FBA [12].

Organic FB are the most common items aspirated by children, whereas in adults the nature of the FB is highly variable (i.e. dental debris, appliances, or prostheses).

Inhaled vegetable matters, such as peanuts, seeds and nuts, because of their oil content, can lead to severe mucosal inflammation and accumulation of bulky granulation tissue within a few hours leading to complication such as tracheo-bronchial mucosal bleeding during the extraction procedure.

The majority of aspirated foreign bodies are located in the bronchi [5, 9, 13].

## Presentation

In children FBA is a potentially life-threatening event. In adults acute presentation is rare and the diagnosis is frequently overlooked; a FB may be noted unexpectedly during fiberoptic bron-

choscopy performed for symptoms of endo-bronchial disease.

In children, presentation and diagnosis within 24 hours of aspiration occurs in approximately 50 to 75 percent of cases [5, 9]. A history of choking, defined as the sudden onset of cough and/or dyspnoea and/or cyanosis ("penetration syndrome") in a previously healthy child, is an important indicator of FBA [4, 5, 9, 10, 14, 15]. However, the acute episode can subside spontaneously and quickly even when a FB remains, and may be followed by a symptom-free period, which must not be misinterpreted as a sign of resolution. On the other hand, the choking events may be not witnessed or unrecalled. Hence, when pulmonary symptoms develop in an otherwise healthy child, detailed and repeated questioning of all caregivers may be necessary to stimulate recall of a choking episode. The most important factor in the failure to diagnose the presence of a FB is the failure to think of the possibility.

Clinical signs may be absent. The classic triad of wheeze, cough, and diminished breath sounds is not universally present (60 to 80 percent for the cases of FBA) [7].

Plain radiographic evaluation is normal in nearly two-thirds of cases [5]. The diagnosis of FBA is easily established with plain radiographs when the object is radioopaque (3 to 5 percent for the cases of FBA) [16]. However, most objects aspirated are radiolucent, and are not detected with standard radiographs unless aspiration is accompanied by airway obstruction or other complications (hyperinflated lung, atelectasis, mediastinal shift, and pneumonia). Negative radiography should not preclude bronchoscopy in patients with a strong history.

A number of reviews have looked at the sensitivity and specificity of signs and symptoms in FBA. Martinot *et al.* reviewed the signs of FBA and found unilaterally decreased breath sounds and lung hyperinflation to be the most predictive signs for this condition [17]; however negative clinical picture should not preclude bronchoscopy in patients with a strong history.

Once the diagnosis is established, extraction must be performed without delay. The disadvantages of delaying diagnosis include potentially increased morbidity due to prolonged distal lung obstruction (recurrent pulmonary infections, atelectasis, and bronchiectasis) [18, 19] as well as the potential for FB to dislodge with fatal airway obstruction.

### Management

The use of flexible or rigid bronchoscopy has been a matter of debate in recent decades. Although some benefits (i.e. less invasive, more cost-effective, does not require general anaesthesia) have been reported by proponents of flexible bronchoscopy [20], rigid bronchoscopy is the procedure of choice for removal of aspirated foreign bodies in children [17].

The rigid bronchoscope allows:

- excellent access to the subglottic airways and gas exchange: the great advantage of placing the rigid bronchoscope without prior intubation is that the trachea is entered under continuous vision, and this allows a subglottic or high tracheal FB to be seen thus reducing the risk of sudden obstruction from dislodging it;
- use of rigid forceps to securely grasp the FB: when an impacted FB obstructs a mainstream bronchus, accidental migration of the FB or its fragments into the contralateral lung during the extraction procedure is potentially lethal;
- management of mucosal haemorrhage: inflammatory lesions encasing FB are friable and may bleed when touched [11, 21, 22].

During the extraction procedure, it is crucial not to push the FB distally with the bronchoscope, the forceps, or the suction catheter. The optical forceps are then advanced in the bronchial axis, a few millimetres proximal to the FB. For smooth and rounded FB, the key is to grip the largest volume of the FB. In this setting, the smooth forceps (foreign body forceps) are preferred to the sharp alligator forceps. The forceps' cups are opened maximally and the forceps is advanced under visual control without pushing the FB downwards. The FB is then gently but securely gripped. Both forceps and FB are pulled up, a few millimetres distal to the tip of the bronchoscope, and then the instruments and FB are withdrawn *en masse* from the trachea when the foreign body is too large to be withdrawn through the bronchoscope.

During the last step of extraction, the FB can be lost accidentally, either because it is blocked in the narrow glottic area, or because there was some inappropriate coaxial movement between the bronchoscope and the forceps. If this occurs, the operator should first carefully inspect the oral cavity and the larynx prior to reintubating the trachea with the bronchoscope.

Once the FB is removed, the trachea is re-intubated with the rigid bronchoscope and the airways are carefully re-examined, ideally with a fiberoptic bronchoscope passed through the rigid tube, to rule out another FB or residual fragments [23].

Vigorous grasping of friable FB, such as peanuts, should be avoided, since it may result in maceration and distal wedging of small fragments.

If the FB is round, a Fogarty balloon catheter can be used to displace the FB upwards after inflating the catheter distal to the FB [24, 25].

Fiberoptic bronchoscope can be used:

- to confirm the diagnosis of FBA,
- to precise identification and localisation of FB,
- to examine distal parts of the bronchial tree.

However, the operator must be aware that, even in patients with stable respiratory status, clinical decompensation may occur during the diagnostic procedure due to accidental dislodgement of the FB. Thus, the bronchoscopist performing the diagnostic procedure must be able to perform both flexible and rigid bronchoscopy to convert immediately to the extraction procedure and when FBA is suspected.

Also explorative fiberoptic bronchoscopy should be performed in a operating or procedure room fully equipped for managing airway emergencies.

Fiberoptic is superior to rigid bronchoscope in the setting of a distally wedged FB, in mechanically ventilated patients, or in the presence of spine, craniofacial, or skull fractures that prevent the manipulation required for rigid bronchoscopy [12].

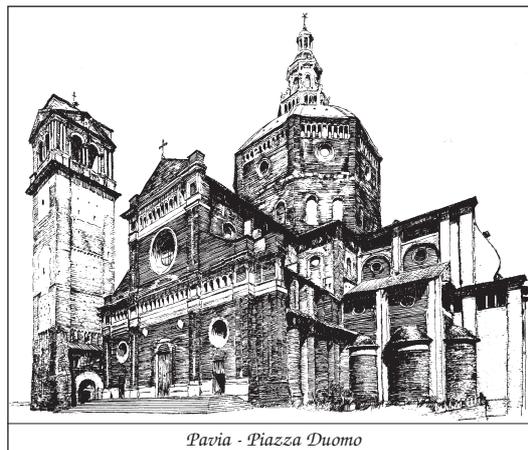
### Recommendations

- **Rigid bronchoscopy is the procedure of choice for removal of aspirated foreign bodies in children. Fiberoptic bronchoscope can be safely used in adults; however, the bronchoscopist performing the extraction procedure must be able to perform both flexible and rigid bronchoscopy (Grade C).**
- **Explorative bronchoscopy and removal of a tracheobronchial foreign body by rigid bronchoscopy in children should be performed by well trained staff in a operating or procedure room fully equipped for managing airway emergencies (Grade C).**
- **Unilaterally decreased breath sounds and lung hyperinflation are the most predictive signs for foreign body aspiration; however negative clinical and/or radiography should not preclude bronchoscopy in patients with a strong history (Grade C).**

### References

1. Casalini AG. Broncoscopia operativa pediatrica: I corpi estranei tracheobronchiali in età pediatrica. In: Casalini A.G. (ed). *Pneumologia Interventistica*. Springer Editore, pp 655-66.
2. Rothmann BF, Boeckman CR. Foreign bodies in the larynx and tracheobronchial tree in children. A review of 225 cases. *Ann Otol Rhinol Laryngol* 1980; 89:434-6.

3. Inglis AF Jr, Wagner DV. Lower complication rates associated with bronchial foreign bodies over the last 20 years. *Ann Otol Rhinol Laryngol* 1992; 101: 61-6.
4. Francois M, Thach-Toan, Maisani D, *et al.* Endoscopy for exploration for foreign bodies of the lower respiratory tract of the child. Apropos of 668 cases. *Ann Otolaryngol Chir Cervicofac* 1985; 102: 433-41.
5. Eren S, Balci AE, Dikici B, *et al.* Foreign body aspiration in children: experience of 1160 cases. *Ann Trop Paediatr* 2003; 23: 31-7.
6. Burton EM, Brick WG, Hall JD, *et al.* Tracheobronchial foreign body aspiration in children. *South Med J* 1996; 89: 195-8.
7. Mu L, He P, Sun D. Inhalation of foreign bodies in Chinese children: A review of 400 cases. *Laryngoscope* 1991; 101: 657-60.
8. Schmidt H, Manegold BC. Foreign body aspiration in children. *Surg Endosc* 2000; 14: 644-8.
9. Tan HK, Brown K, McGill T, *et al.* Airway foreign bodies (FB): a 10-year review. *Int J Pediatr Otorhinolaryngol* 2000; 56: 91-9.
10. Ciftci AO, Bingol-Kologlu M, Senocak ME, *et al.* Bronchoscopy for evaluation of foreign body aspiration in children. *J Pediatr Surg* 2003; 38: 1170-6.
11. Pasaoglu I, Dogan R, Demircin M, *et al.* Bronchoscopic removal of foreign bodies in children: Retrospective analysis of 822 cases. *Thorac Cardiovasc Surg* 1991; 39: 95-8.
12. Limper AH, Prakash UBS. Tracheobronchial foreign bodies in adults. *Ann Intern Med* 1990; 112: 604-9.
13. Black RE, Johnson DG, Matlak ME. Bronchoscopic removal of aspirated foreign bodies in children. *J Pediatr Surg* 1994; 29: 682-4.
14. Blazer S, Naveh Y, Friedman A. Foreign body in the airway. A review of 200 cases. *Am J Dis Child* 1980; 134: 68-71.
15. Lea E, Nawaf H, Yoav T, *et al.* Diagnostic evaluation of foreign body aspiration in children: a prospective study. *J Pediatr Surg* 2005; 40: 1122-7.
16. Hoeve LJ, Rombout J, Pot DJ. Foreign body aspiration in children. The diagnostic value of signs, symptoms and preoperative examination. *Clin Otolaryngol* 1993; 18: 55-7.
17. Martinot A, Closset M, Marquette CH, *et al.* Indications for flexible versus rigid bronchoscopy in children with suspected foreign-body aspiration. *Am J Respir Crit Care Med* 1997; 155: 1676-9.
18. Denney MK, Berkas EM, Snider TH, Nedwicki, EG. Foreign body bronchiectasis. *Dis Chest* 1968; 53: 613-6.
19. Al-Majed SA, Ashour M, al-Mobeireek AF, *et al.* Overlooked inhaled foreign bodies: late sequelae and the likelihood of recovery. *Respir Med* 1997; 91: 293-6.
20. Prakash UB, Midthun DE, Edell ES. Indications for flexible versus rigid bronchoscopy in children with suspected foreign-body aspiration. *Am J Respir Crit Care Med* 1997; 156: 1017-9.
21. Wood RE, Gauderer MWL. Flexible fiberoptic bronchoscopy in the management of tracheobronchial foreign bodies in children: The value of a combined approach with open tube bronchoscopy. *J Pediatr Surg* 1984; 19: 693-8.
22. Banerjee A, Rao KS, Khanna SK, *et al.* Laryngo-tracheo-bronchial foreign bodies in children. *J Laryngol Otol* 1988; 102: 1029-32.
23. Kim IG, Brummitt WM, Humphry A, *et al.* Foreign body in the airway: a review of 202 cases. *Laryngoscope* 1973; 83: 347-54.
24. Kosloske AM. Tracheobronchial foreign bodies in children: back to bronchoscope and a balloon. *Pediatrics* 1980; 66: 321-3.
25. Good GM, Deutsch ES. Method for removing endobronchial beads. *Ann Otol Rhinol Laryngol* 1998; 107: 291-2.



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