

Pediatric Interventional Pulmonology



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KEYWORDS

- Pediatric interventional bronchoscopy • Foreign body aspiration • Foreign body removal
- Congenital tracheal stenosis • Bronchoscopic dilatation • Airway stents • Bronchoscopic laser

KEY POINTS

- Choking (FB aspiration) remains a frequent reason for pulmonary consultation in pediatric emergency departments.
- Foreign body removal is the most common interventional procedure in the pediatric airway.
- Mechanical dilatation, airway stents, and bronchoscopic laser in children continuously benefit from adult interventional pulmonology experience and evolving technologies.
- Indications, goals, and technical constraints for pediatric interventional bronchoscopy are entirely different from those of adult patients.
- The number of pediatricians trained in interventional bronchoscopy procedures remains low.

The bronchoscope was born interventional, because of foreign body (FB) aspiration when Gustav Killian first used a Miculicz rigid bronchoscope (RB) (Freiburg 1897). Subsequently, Chevalier Jackson developed the procedure in pediatric patients and designed many tools in the early 20th century. The indications were not limited to FB removal. They also included central airway recanalization. In 1967 Shigeto Ikeda designed the first fiberoptic bronchoscope (FOB), but pediatricians had to wait until the 1980s for suitable instruments. Today both types of bronchoscopes are used worldwide.

FOB is more suited for diagnostic procedures and bronchoalveolar lavage, whereas RB is more useful for interventional procedures, such as recanalization and removing foreign bodies. RB is cheaper, more versatile, and cost-effective. Disinfection, storage, and maintenance of RB is easily achieved along

with other operating room instruments. FOBs are expensive and fragile and require specialized machines and staff for maintenance and disinfection. Thus the overall cost of FOB is prohibitive in developing countries. However, because of ease of use, most endoscopists who can afford FOB primarily use FOB and have limited experience with RB, which is traditionally reserved by otorhinolaryngologists and thoracic surgeons. Disadvantages of pediatric FOB include the size of working channel that severely limits instrumentation compared with RB through which larger and multiple instruments can be passed simultaneously and allow two operators to work (four-hands working). Moreover, the RB can be used by itself for mass debulking or incarcerated FB extraction. Endoscopists who are trained and have access to both RB and FOB can choose the most appropriate techniques and instruments depending on the indication.^{1,2}

Disclosure: The authors declare no conflict of interest.

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Clin Chest Med 39 (2018) 229–238

<https://doi.org/10.1016/j.ccm.2017.11.017>

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FOREIGN BODY ASPIRATION

Epidemiology

The actual prevalence of the FB aspiration is unknown because most of it goes unreported. Nevertheless, countless children present to the emergency rooms with “choking” (FB aspiration) around the world, sometimes in a life-threatening respiratory compromise. In a recent meta-analysis, 30,477 pediatric cases have been reviewed from 174 papers reporting an overall complication rate of 16% with 4.4% cardiorespiratory arrests and 6.2% deaths.³ The authors conclude that we should be able to do better and also point out the lack of preventive measures. In the largest pediatric published series, FBs were organic in 67% of cases, widely dominated by peanuts (6 of 10).⁴

Diagnosis

A significant number of people including not only parents but also medical practitioners still believe that the absence of clinical symptoms and the normality of chest radiograph after choking crisis rules out FB aspiration. As a consequence, a 24-hour or more delay is observed in the diagnosis in up to 60% of the cases.^{3,4} The risk for chronic complications is proportional to the delay in FB removal, particularly with organic FBs predisposing to pneumonia, hemoptysis, and bronchiectasis.⁵⁻⁷

In our experience of hundreds of children with a choking crisis (FB aspiration), no clinical symptoms were found to be pathognomonic, and some children with proven FB aspiration were asymptomatic (Fig. 1). In published series radiopaque FBs range from 1% to 10%.^{3,6-10} The most frequently aspirated FBs are radiolucent

because they are organic or made of plastic. They produce various indirect radiologic signs; the most evocative is unilateral gas trapping, but this particular feature is difficult to notice on a standard chest radiograph (Fig. 2). In our experience, no radiologic abnormalities were reported in some children with confirmed FB aspiration. Although several recent publications emphasize the use of chest computed tomography (CT) as a prebronchoscopic evaluation in patients with suspected FB aspiration, its place remains unclear (Fig. 3).¹¹⁻¹³ Bronchoscopy remains the gold standard for the diagnosis of FB aspiration.

Bronchoscopy: When and How?

The timing of bronchoscopy

The timing of bronchoscopy depends on visible vital signs. In case of witnessed FB aspiration, suffocation, or severe dyspnea and failure of Heimlich/Mofenson or laryngoscopic maneuvers, the patient should be immediately referred to a level 3 center under strict observation for further airway compromise. In this situation the most likely locations for the FB impactions are larynx, trachea, or mainstem bronchi (multi-fragment FB). Medical transport should be careful, keeping in mind that too much moving, jerking, or rotations are contraindicated to avoid upward migration of the FB. Most non-life-threatening FBs should be extracted within 12 to 24 hours. The most likely locations for FB impactions are larynx, trachea, or mainstem bronchi (multifragment FB). The removal delay should not exceed 12 to 24 hours.

Chronic FB retention is an entirely different situation. The FB is usually incarcerated in mucosal granulation tissue, and the risk of spontaneous displacement is minimal. Initial evaluation by

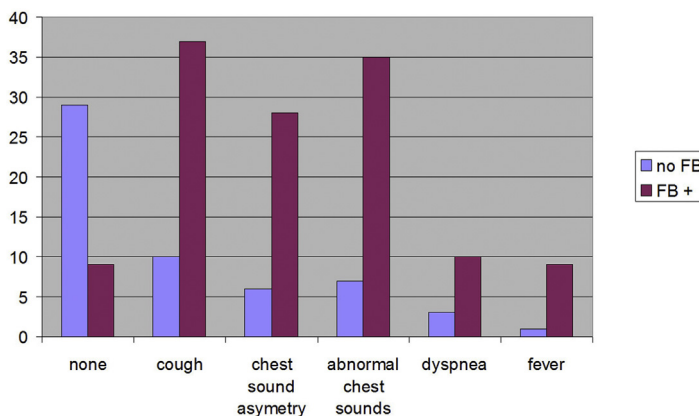


Fig. 1. Clinical symptoms. Signs and complaints from 136 children presenting to the emergency room after a choking episode.

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