Rigid Nephroscope for Therapeutic Bronchoscopy: Our Experience of Emergency Bronchial Foreign Body Removal in 13 Pediatric Patients

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ABSTRACT

Tracheo-bronchial foreign bodies in patients are considered to be life-threatening and need emergency management. They are commonly seen in the pediatric population which needs special attention. In hospital settings after primary measures, bronchoscopy using a flexible video bronchoscope or rigid bronchoscope is performed for diagnostic and therapeutic purposes. Here, we suggest the advantages of a rigid nephroscope over the above in the management of trachea-bronchial foreign bodies as per our experience. We managed to remove 13 pediatric bronchial foreign bodies using a rigid nephroscope more efficiently and with more ease using a nephroscope.

Key Words: Nephroscope, Bronchoscope, Foreign body

INTRODUCTION

Accidental lodgement of unwanted things in the respiratory tract, known as airway foreign bodies (AFBs), is a potentially life-threatening emergency. The commonest site for airway foreign body is the right lower bronchus or its bronchus intermedius as it is more vertical, shorter and wider¹.

Epidemiology

It was recently studied that the incidence of FBAO to be 0.66 per 100000.² And it also contributes to the highest accidental infantile mortality and the fifth cause of death among less than five years³.

Airway foreign bodies have very special demography. 80% of cases are found to be of age less than 3 years, among which maximum is found between 1–2 years of age⁴ Asif et al. in his study of 83 cases highlighted that 77.8% of foreign bodies are aspirated by children under 5 years, 16% by children between 5–15 years, and 6.2% by those above 15 years. Similarly, Reilly et al.⁵ in his study found that children younger than 4 years are more vulnerable to inhale bodies

because they are they tends to explore more with the molar free mouths and their swallowing reflex is also less coordinated. The inhaled foreign body tend to obstruct the airway due to the small diameter of trachea and bronchi in children.⁶ Additionally, Yadav et al.⁷ and Brkić and Umihanic⁸ demonstrated that 46% and 65.2% of their sample were ≤ 3 years, respectively. The adventurous and impulsive behavior of male was found to justify that airway foreign body was more common in males⁹

There was a significant variation in the type of foreign body which was inhaled. It was found that 91% of western patients inhaled organic materials, peanuts account for half of that.¹⁰ However, bones were the most common AFBs in southeast Asia and China.^{11,12} Similarly, seeds of watermelons, sunflowers, and pumpkins are more prevalent in Egypt, Turkey, and Greece, respectively.¹³

Etiology: The etiology highly depends on the age of the patient, their provocative mischievous nature, and types of food. For example, toys, coins, etc should not be treated by mouth. Some types of food require a higher level of skills to

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deal with which makes it age-restricted, i.e. peanuts for pre-school children who lack the necessary skills of mastication. They also tend to inhale food or toys while during increased physical activity.

Finally, AFBs may occur because of the misdirecting of solid food or liquid fluids into the airways rather than the gastrointestinal tract during the second stage of deglutition, the pharyngeal stage¹⁴. Alternatively, an endogenous source may obstruct airways as seen in the case of mucoid impaction or bronchial casts formation characterizing plastic bronchitis¹⁵.

Clinical features: A pediatric patient with inhaled foreign objects will try to induce sudden gag and discomfort as they pass down through the vocal cords and epiglottis¹⁶. It is found that the tracheal-bronchial foreign bodies present with a typical clinical presentation: wheezing, slapping sound from rubbing of the trachea, and palpable thud¹⁷. There is also a presentation called Penetration syndrome, i.e. in this the patient has choking and severe coughing followed by vomiting which is characteristic of endobronchial bodies¹⁸.

Studies have shown that clinical examination is also about 90% sensitivity in diagnosis¹⁹. The signs may include raspy respiration, and dyspnea²⁰, accordingly, decreased oxygen saturation hypoxia, hypercapnia, and cyanosis develop. The patient may also have asthmatic wheezing on ipsilateral side on auscultation. A special high pitched wheeze, known as sonorous ronchi, is suggestive of large airway foreign body²¹.

Diagnosis: Diagnosis is based on a detailed history, a proper examination, and Chest X-ray findings. SNAPPS is a six-step technique (summarize history and findings, narrow the differential, analyze the differential, probe preceptor about uncertainties, plan management, select case-related issues for self-study) for case presentations in an outpatient setting.²² If anyone of the above modalities is positive, a diagnostic bronchoscopy is performed. If none of them are suggestive, then both physical examination and chest X-ray should be done 24 hours apart given a negative history and inconclusive initial examination and imaging in a stable patient.²³

Management: Most of the places flexible bronchoscopy is done for diagnosis. However, new studies defined a new role for them in treatment, particularly, when combined with ureteral stone baskets and forceps²⁴, on being performed by experts, foreign bodies can be removed in more than 90% of cases.^{25,26} This was also quoted by Both Ramírez-Figueroa et al.²⁷ and Tang et al.²⁸ their two separate studies.

It was also seen that these patients in the future can lead to bronchiectasis and one of the most effective and least costly interventions for bronchiectasis is airway clearance exercises which can be done with flexible bronchoscopy. But, Raja Dhar et al. data these procedures are not much used in India, could be due to substandard facilities available. They suggest

that it can prevent the frequency and intensity of bronchiectasis thus improving patients overall health.²⁹

Since 1920s, the modality of choice for managing trachea-bronchial foreign bodies has been a rigid bronchoscope. It has good visualization, enables ventilation during general anesthesia and can be used with a wide range of instruments for foreign body retrieval³⁰ Its success rates range from 95% to 99%^{31,32}. Surgical procedures like tracheostomy, bronchostomy, and thoracotomy are performed when all the conservative options fail 0.3%–4%.^{33,34}

MATERIAL & METHODS

The present study was conducted in the Dept. of ENT and Dept. of Pediatrics at Datta Meghe Medical College in collaboration with Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences Sawangi, Meghe, Wardha, Maharashtra. Between 2018-2020, we received 13 children with respiratory distress, probable cases of airway foreign body at accident and emergency of our hospital. All of them belonged to pediatric age group. Only one patient was 2.5 years old, rest of them were between 3-5 years of age. There were 9 males and 4 females, the youngest being a male. Most of the foreign bodies were vegetative except a battery and a pen cover.

A detailed history taking and examination revealed a diagnosis of the probable airway (tracheobronchial) foreign body in the children, hence they were all admitted for further management. They were kept nil orally and posted for emergency bronchoscopy under sedation. Diagnostic bronchoscopy was done with a flexible video-bronchoscope, which suggested a tracheobronchial foreign body in all of them. Two of the children had trachea foreign bodies, eight of them had foreign bodies lodged in the right main bronchus and three of them in the left main bronchus.

Hence, everyone was taken up for emergency trachea-bronchial foreign body removal under general anesthesia. Setting us apart from others, we used a rigid adult nephroscope to retrieve foreign bodies from the trachea and bronchi and could successfully remove all of them. All the procedures were uneventful, except one female child who had inhaled custard apple seed which got lodged in the right main bronchus. It was very difficult due to the slippery nature of the foreign body and needed multiple attempts for removal. It was finally removed but we had to perform a tracheostomy to prevent airway obstruction secondary to laryngeal edema.

DISCUSSION

Since the time of Chevalier Jackson, an innumerable numbers of pediatric foreign bodies have been documented and

managed successfully. Several recent advances in type of forceps, endoscopes, and endoscopic airway management have revolutionized the procedures to remove various foreign bodies without open surgery.

Till date, pediatric rigid bronchoscope has been the choice of instrument in pediatric trachea-bronchial foreign bodies. It has a dual advantage of diagnosis and management at the same time saving precious time. As mentioned earlier It also It has good visualization (diameter – 8mm) enables ventilation during general anesthesia and can be used with a wide range of instruments for foreign body retrieval.³⁰ Its success rates range from 95% to 99%^{31,32}

The only issue with the rigid scope is, it cannot be used for teaching purpose like it has been seen that in medical schools, throughout the world, the technique of giving instruction includes traditional lecture method, problem-based learning (PBL), computer-based learning, teamwork, seminar, and symposium.³⁵

Recently surgeons have started using Olympus pediatric flexible video bronchoscope for diagnosis, and then in the same sitting retrieval of tracheobronchial foreign bodies with the crocodile forceps or foreign body removal forceps. But this has to be done under sedation or short general anesthesia mainly, since the pediatric endotracheal tubes have a very narrow lumen, scope and endotracheal tubes are difficult to negotiate at the same time. Moreover, the forceps used in pediatric flexible video bronchoscope are very delicate and small, most of the time fail to retrieve the foreign body, as per our experience.

We did not have a pediatric rigid bronchoscope at our hospital, the only adult was available. So we tried to use the flexible pediatric video bronchoscope for diagnosis and management of our pediatric trachea-bronchial foreign body patients. But as described earlier due to small diameter (2.2mm) and lumen of flexible scope, it was difficult to suction, visualize, and retrieve foreign bodies at the same time.

So, we decided to use the available Storz rigid adult nephroscope (diameter – 4.2mm) to manage the cases. The rigid adult nephroscope has an attachment of light source and camera, unlike the rigid bronchoscope, allowing better illumination and visualization on the monitor screen. It has a channel for efficient suctioning which can be done simultaneously during the procedure, whereas in rigid bronchoscope we have to do suctioning intermittently with external suction. It has a channel for irrigation, which can be used for ventilation/oxygenation in bronchoscopy cases. It has a channel for instrumentation through which we can negotiate good size instruments like renal stone graspers, baskets to retrieve the foreign body. Using this, all the foreign bodies were retrieved successfully.

CONCLUSION

Rigid nephroscope successfully proved to be an efficient alternative for emergency therapeutic management of trachea-bronchial pediatric foreign bodies. It has a better illumination and enhanced visualization on the monitor which can be used for tutorial purposes, unlike the rigid bronchoscope where only the primary surgeon can visualize. It has a wider port for simultaneous suction and irrigation port for oxygenation which the pediatric flexible scope lacks. And the larger and more rigid renal stone graspers or baskets give a better hold of foreign body, preventing it from slipping back into the airway. The rigid nephroscope improves the efficiency, ease, and time management in pediatric trachea-bronchial foreign body removal. Thereby, proving a much better alternative for the classical bronchoscope.

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