Rigid Bronchoscopy in Pediatric Patients

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Abstract Aspiration of foreign-bodies remains a major life-threatening situation in children and have always been a source of interest and confusion to otolaryngologists due to their varied presentations. These conditions if not promptly diagnosed and managed can prove to be fatal, but the current mortality is only one percent compared to pre bronchoscopy era (Rothman and Boeckman in *Ann Otol Rhinol Laryngol* 89:434–436, 1980). Peak incidence of this condition is in early childhood due to child's habit of putting small objects in mouth to determine their taste and texture and chew while teething. This is a study conducted retrospectively from 2012 to 2017 in a tertiary care center. It includes a total of 70 cases of foreign body in airway who underwent rigid bronchoscopy under general anaesthesia. The patients were all in paediatric age group but mostly between 6 months to 3 years. The youngest patient was 3 months old and the oldest 12 years old. Male children (70%, $n = 49$) were more common than female children (30%, $n = 21$) with a male to female ratio of 2.33:1. A definite history of foreign body aspiration was given in only 70% cases, but the most common symptom were cough (100%) and breathlessness (80%). Organic foreign bodies (76.36%, $n = 42$) were more common when compared to inorganic foreign bodies. Foreign body most commonly impacted in Right main bronchus (49.09%, $n = 27$) followed by Left main bronchus (31.42%) and lastly the trachea (19.49%). Even though the mortality in patients of foreign body aspiration is low, it is essential to have proper cooperation between the otolaryngologists,

paediatrician and the radiologist for rapid diagnosis and prompt management. It is advised to have a second look to check all the bronchopulmonary segments. Life saving steps are Prompt referral, early diagnosis and vigilant management.

Keywords Rigid bronchoscopy · Foreign body · Paediatric patients

Introduction

Aspiration of foreign-bodies remains a major life-threatening situation in children and have always been a source of interest and confusion to otolaryngologists due to their varied presentations. The first successful bronchoscopy was performed by Gustav Killian in 1897 with a 9 mm tube [1]. Eihorn in 1902 made the procedure much easier and safer by adding distal illumination. Presentation of child may include a history of aspiration given by parents, paroxysms of cough preceded by choking or pneumonia with no response to standard medical treatment. These conditions if not promptly diagnosed and managed can prove to be fatal, but the current mortality is only one percent compared to pre bronchoscopy era [2]. Peak incidence of this condition is in early childhood due to child's habit of putting small objects in mouth to determine their taste and texture and chew while teething. Anatomically it is more common for foreign bodies to be lodged in right bronchus, also the infant larynx is positioned higher in neck compared to adult larynx [3].

Various applications of rigid bronchoscopy in paediatric patients are either Diagnostic or Therapeutic [4]. Some times long standing foreign bodies may remain asymptomatic and may present with complications like

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bronchiectasis, atelectasis and death. There is higher mortality in vegetable foreign bodies as they produce intense inflammatory reaction leading to mucosal edema and granulation tissue production. The golden dictum is ‘The clinician should be prepared to undertake bronchoscopy on the basis of history alone’ [5]. This study aims at discussing the various clinical presentations, types and the subsequent management of foreign bodies in airway by rigid bronchoscopy.

Materials and Methods

This is a study conducted retrospectively from 2012 to 2017 in a tertiary care center. It includes a total of 70 cases of foreign body in airway who underwent rigid bronchoscopy under general anaesthesia. The patients were all in paediatric age group but mostly between 6 months and 3 years. The decision to do bronchoscopy was taken with support of history, clinical presentation of respiratory distress or worsening of patient in spite of conservative management. Along with all these a high degree of clinical suspicion was very important. Radiological assessment by X-rays and CT scans were done in cases where time permitted as per the patient’s general condition. Clinical features correlating well with positive bronchoscopic findings were sudden severe coughing, respiratory difficulty, non responding upper respiratory tract infection to standard treatment protocols, cyanosis, unequal air entry on chest auscultation. The rigid bronchoscopy procedure proved therapeutic in 55 patients i.e. the foreign body was found in 55 patients, and diagnostic in the rest. The procedure along with its intra operative and post operative complications were properly explained and a written consent was taken from the closest relatives of the patient. Repeat check bronchoscopy was carried out in all patients and tracheostomy was needed in 10 patients to saturate the patient. Antibiotics, steroids and oxygen were needed in most of the cases. Patients were kept in paediatric ICU, Chest x ray was done on day one. After the symptoms completely resolved and patients respiratory functions improved patients were discharged with a follow up after 1 month.

Results

Rigid bronchoscopy was performed in 70 patients. The youngest patient was 3 months old and the oldest 12 years old. Surgery was done in general anaesthesia under an experienced anaesthesiologist as in this case both the operating surgeon and the anaesthetist are working in the airway.

Age group (in years)	Percentage of patients
1–3	61.4
3–6	25.3
6–12	13.3

Most of the children belonged to lower socio-economic group (88%). 1–3 years of age group (61.4%, $n = 43$) was the most common age of presentation. Male children (70%, $n = 49$) were more common than female children (30%, $n = 21$) with a male to female ratio of 2.33:1, Sinha et al. has mentioned like that it is probably due to comparatively less attention to male children, but it is a very debatable topic. Only nine patients (12.85%) presented within a day. Majority presented within 5–7 days but surprisingly five cases (7.14%) presented after a month with recurrent pneumonia non responsive to medical management.

Cause for Bronchoscopy:

Etiology	Percentage of patients
Foreign body aspiration	81.81
Subglottic Stenosis	8.57
Mucous plugs	4.29
Miscellaneous	5.33

Leading cause for rigid bronchoscopy was foreign body aspiration (81.81%, $n = 45$) followed by Subglottic stenosis (8.57%), Mucous plugs (4.29%). A definite history of foreign body aspiration was given in only 70% cases, but the most common symptom were cough (100%) and breathlessness (80%). Radio opaque foreign bodies were seen only in 18.18% cases ($n = 10$), but in most cases x ray implied the presence of foreign body with lung collapse, atelectasis, obstructive emphysema or pneumomediastinum etc. Emergency tracheostomy was done preoperatively in 10 cases and 6 cases needed tracheostomy post operatively to maintain the airway till the edema subsided. Organic foreign bodies (76.36%, $n = 42$) were more common when compared to inorganic foreign bodies. Among organic peanut (49.09%) and betel nut (17.14%) were most common. Inorganic foreign bodies found were pen clip, screws, pen caps, beads etc.

Site of foreign body	Percentage of patients
Right main bronchus	49.09
Left main bronchus	31.42

Site of foreign body	Percentage of patients
Trachea	19.49

Foreign body most commonly impacted in Right main bronchus (49.09%, $n = 27$) followed by Left main bronchus (31.42%) and lastly the trachea (19.49%).

Discussion

Rigid bronchoscopy is a safe procedure in experienced hands compared to ancient times due to better illumination, Hopkins rod lens system and usage of ventilating rigid bronchoscope. Also anaesthetic technique has evolved a lot. Choking, paroxysmal coughing followed by unilateral wheezing is not seen as a classical triad in most of the laryngo-tracheo-bronchial foreign bodies. In a study of R Al-Hilau [6] of 74 patients history was predictive of foreign body in 94% of cases compared to our study in which it is 70%. Varying complications are seen following a delay in diagnosis, based on the location of FB [7]. In a study by Karen in 2013 of 17,537 children, 160 deaths were caused due to delay in performing bronchoscopy. The male to female ratio is 2.33:1 which is comparable to previous study of Sinha et al. [8]. Similar to Massie et al. [9] 1–3 years was the most common age group. This may be due to absent denture, still adjusting to descent of larynx, habit of crying, speaking while eating and also uncoordinated swallowing reflexes. Most of the patients belonged to lower socio economic strata due to lack of health education and proper attention not being given to children [10]. In 1982–1983 in Israel educational campaign was once through TV, radio, news papers and it reduced incidence of FB. The number of patients presenting within 24 h of aspiration are 12.85% whereas majority presented within 5–7 days. This may be due to the reason that cough, breathlessness subside within 24 h because of adaptation of trachea-bronchial tree and present later with consequences. The delay in diagnosis may be late due to not so high degree of suspicion and treating the patient as routine upper respiratory tract infection. Foreign body most commonly impacted in Right main bronchus (49.09%, $n = 27$) followed by Left main bronchus (31.42%) which is slightly more compared to Ma et al. [11] (38.9%) which may be due to the anatomical reasons like right bronchus is 5 cm in length and makes an angle of 30° with trachea [12] whereas left bronchus is 5.5 cm in length and makes an angle of 45° . Among foreign bodies found in bronchoscopy, organic (76.36%, $n = 42$) were more commonly found compared

to inorganic foreign bodies (23.64%, $n = 13$). The commonest organic foreign body found was peanut (49.09%, $n = 27$) as it is very commonly grown in saurashtra region of Gujarat, which is similar to finding of Sinha et al. [13] (41%) and Fazal-I-Wahid et al. [14] (45.25%). There was no mortality in our study (0%) which is reasonable when compared to Hasdiraz et al. [15] (0.77%). Post op monitoring of patients was needed, it included antibiotics with steroids and nebulization with oxygen and bronchodilators.

Conclusion

A significant cause of morbidity and mortality in children is aspiration of foreign body causing upper airway obstruction. Jackson's dictum states that "In suspected cases of foreign body of air passages, bronchoscopy must be done as failure to do bronchoscopy is more disastrous than complications of bronchoscopy" Even though the mortality in patients of foreign body aspiration is low, it is essential to have proper cooperation between the otolaryngologists, paediatrician and the radiologist for rapid diagnosis and prompt management. With a complete range of paediatric bronchoscopes being available along with various types of foreign body removal forceps and accessories it is essential to ensure a comfortable and confident endoscopy for safety of the patient. The only thing an ENT surgeon wishes while visualizing and treating closed spaces is "If I could put my eyes inside". Perfect history taking is a cardinal requirement prior to the procedure [16] and is much better guide compared to radiological assistance. Proper anaesthetic management is always helpful to a surgeon, as it is a shared working space and a competent anaesthetist will buy more time for surgeon with minimal trauma or hindrance to the airway. It is advised to have a second look to check all the bronchopulmonary segments. Life saving steps are Prompt referral, early diagnosis and vigilant management. The motto for surgeon doing bronchoscopy should be "Be Brave Be Aware BeWare".

Compliance with Ethical Standards

Conflict of interest Vikas Sinha, T. U. Samanth and Sushil G. Jha declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

1. Prakash UBS, Diaz-Jimanez JP (1994) The rigid bronchoscope. In: Prakash UBS (ed) *Bronchoscopy*. Raven Press, New York, pp 53–69
2. Rothman BF, Boeckman CR (1980) Foreign bodies in larynx and tracheobronchial tree in children. A review of 225 cases. *Ann Otol Rhinol Laryngol* 89:434–436
3. Standring S *Gray's anatomy* 14th edition, pp 577–594
4. Sen MK, Suri JC (2000) Therapeutic bronchoscopy. *Indian J Chest Dis Allied Sci* 42:167–177
5. Stradling P (1991) *Diagnostic bronchoscopy*, 6th edn. Churchill Livingstone, Edinburgh, p 3
6. Al-Hilau R (1991) Inhalation of foreign bodies by children: Review of experience with 74 cases from Dubai. *J Laryngol Otol* 105:466–470
7. Sarafoleanu C, Ballali S, Gregori D, Belussi L, Passali D (2012) Retrospective study on Romanian foreign body's injuries in children. *Int J Pediatr Otorhinolaryngol* 76(Suppl1):S73–S75
8. Sinha V et al (2010) Foreign body in tracheobronchial tree. *Indian J Otolaryngol Head Neck Surg* 62(2):168–170
9. Massie J, Fink M (2010) Suspected foreign body inhalation in children: what are the indications for bronchoscopy? *J Pediatr* 156:690–691. doi:[10.1016/j.jpeds.2009.12.009](https://doi.org/10.1016/j.jpeds.2009.12.009)
10. Sadan N, Raz A, Wolach B (1995) Impact of community educational programme on foreign body aspiration in Israel. *Eur J Pediatr* 154:859–862
11. Ma YY, Jiao AX, Jiang QB, Rao XC, Pan YN, Liu XC (2010) Clinical analysis of bronchial foreign bodies in 246 children. *Zhonghua Yi Xue Za Zhi* 90:1272–1274
12. Sinha V (2011) *Bronchoscopy*, Vikas Sinha practical ENT 129
13. Sinha V, Devang G, Bela P, Yogesh M (2007) Foreign body in tracheobronchial tree. *Indian J Otolaryngol Head Neck Surg* 59:211–214. doi:[10.1007/s12070-007-0063-9](https://doi.org/10.1007/s12070-007-0063-9)
14. Fazal-I-Wahid Nimatullah, Habib-Ur-Rehman Gohar Amin, Ahmad Iftikhar (2011) Rigid bronchoscopy for extraction of foreign bodies tracheobronchial tree: an experience of 232 cases. *JPMI* 25(2):152–157
15. Hasdiraz L, Oguzkaya F, Bilgin M, Bicer C (2006) Complications of bronchoscopy for foreign body removal: experience in 1,035 cases. *Ann Saudi Med* 26:283–287
16. Sinha V, Gurnani D, Barot DA (2014) A study of applications of rigid bronchoscopy in pediatric patients. *Indian J Otolaryngol Head Neck Surg* 66:142. doi:[10.1007/s12070-013-0667-1](https://doi.org/10.1007/s12070-013-0667-1)