

## The Role of Bronchoscopy in Foreign Body Aspiration in Children

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### Abstract

**Introduction:** Foreign body aspiration is an otorhinolaryngological emergency which is relatively common in children due to their anatomical predisposition and poor physiological coordination of the swallowing mechanism. This predisposition is further worsened by their increased tendency to put inanimate objects in the mouth. Foreign bodies lodged in the bronchus, can be removed during rigid or flexible bronchoscopy. However, the advent of telescopic bronchoscopy has improved the outcome of bronchoscopy, due to better visualisation with the aid of the telescope. The aim of this study was to evaluate the outcome of the cases of foreign body aspiration managed with bronchoscopy in the University of Port Harcourt Teaching Hospital, Rivers state, Nigeria.

**Method:** This was a retrospective study of 18 patients with foreign body aspiration who had bronchoscopy over a 5 year period from June 2013 to July 2018 in the University of Port Harcourt Teaching Hospital. Data was retrieved from medical records of operating theatre, Ear, Nose and Throat (ENT) ward, and surgical ward. Age, gender, type of foreign body, and location of foreign body was considered. Results were presented as simple tables and figures, and then analysed.

**Result:** 18 (100%) of them had rigid bronchoscopy, among which 6 (33.3%) had telescopic bronchoscopy. There were 11 males and 7 females. 17 patients were aged < 15 years, and all of them had foreign body in bronchus. Foreign body was lodged in the left bronchus in 10 (58.8%) patients, while in 8 (41.2%) patients it was in the right bronchus. Foreign body retrieval failed in 1 patient, and mortality of 1(5.6%) patient was recorded. The highest rate of bronchoscopy 11(61.1%) was noted in patients within age 1-5 years.

**Conclusion:** Bronchoscopy remains the gold standard for management of foreign body aspiration in which the foreign body is lodged in the bronchus. Telescopic bronchoscopy is encouraged for better visualization during procedure. However, early presentation and accurate diagnosis are key to a good outcome.

**Keywords:** Bronchoscopy; Foreign body; Children; Telescope; Aspiration

### Introduction

Bronchoscopy is an invasive procedure done using a flexible or rigid bronchoscope, which is introduced into the trachea-bronchial tree to aid visualisation, diagnosis, or for therapeutic purposes [1]. It was first performed by Gustav Killian in 1897 and since then, the procedure has evolved into a tool that is indispensable in the management of trachea-bronchial tree diseases [2] especially in cases of removal of trachea-bronchial foreign bodies. However, accessibility to hospitals with bronchoscopic facilities, and skilled manpower for bronchoscopic procedures is limited in Nigeria, and these factors contribute to the mortality associated with foreign body aspiration [3].

Foreign body aspiration is an otorhinolaryngological emergency which is relatively common in children due to their anatomical predisposition and poor physiological coordination of the swallowing mechanism [4]. This predisposition is further worsened by their increased tendency to put inanimate objects in the mouth [4]. When an object is aspirated, it can be lodged at either the glottis, subglottis, carina, or in the bronchus, and this depends largely on the age of the individual, and the nature, shape and size of the foreign body. However, change of its position, fragmenting, or migration distally can occur, particularly after an attempt to remove it has been unsuccessful [5]. Foreign bodies lodged in the trachea or bronchus, can be removed during rigid or flexible bronchoscopy. However, the advent of telescopic bronchoscopy has improved the outcome of bronchoscopy, due to better visualisation with the aid of the telescope [3].

The aim of this study was to evaluate the outcome of the cases of foreign body aspiration managed with bronchoscopy in the University of Port Harcourt Teaching Hospital, Port Harcourt, Rivers state, Nigeria.

### Methodology

This was a retrospective study of 18 patients who had bronchoscopy over a 5 year period from June 2013 to July 2018 in our tertiary health institution, the University of Port Harcourt Teaching Hospital, Port Harcourt, Rivers state, Nigeria. The University of Port Harcourt is a tertiary hospital located in Rivers state, with its catchment area covering the 6 surrounding states namely, Bayelsa, Imo, Abia, Akwa-ibom, Delta and Cross river states. It receives patients referred from these states in addition to patients from within the state.

The names and hospital numbers of patients who had foreign body aspiration within this period, were identified and collected from records of Ear, Nose and Throat (ENT) clinic, ENT operating theatre, main hospital theatre, ENT ward, and surgical ward. Permission was sought and gotten from medical records department before the folders of the identified patients were retrieved. Relevant data collected include their age, gender, presenting symptoms, type of foreign body, indication for bronchoscopy, and location of foreign body. Plain chest X-ray was done for all the patients, however, only the X-rays considered peculiar are represented in this report. Diagnosis of foreign body aspiration was made based on history and

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**Received:** May 23, 2019; **Accepted:** June 19, 2019; **Published:** June 26, 2019

**Citation:** Osuji AE, Nwogbo A (2019) The Role of Bronchoscopy in Foreign Body Aspiration in Children. Otolaryngol (Sunnyvale) 9: 372.

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physical examination. Radiological findings on X-ray helped to confirm the location of the foreign body in only some cases.

Out of all the patients who had foreign body aspiration, those with X-rays showing foreign body in the upper airway, and those who did not have bronchoscopy were excluded. Only data of those who had bronchoscopy were analysed.

During bronchoscopy, patients were put in supine position, with neck slightly flexed on shoulder and head extended at atlanto-occipital joint. Bronchoscope was held in surgeon's left hand, and introduced into the right side of the mouth. Tongue is displaced to the left side, as bronchoscope is advanced towards the epiglottis. The bronchoscope is inserted behind the tip of epiglottis, and advanced into the opening of the laryngeal airway. Under good vision, airway is inspected as bronchoscope is advanced into the bronchi, looking out for the foreign body the right hand is used to hold the forceps or the suction cannula as at when or which is required. However, because the ventilating tube has been attached to the anaesthetic port of the ventilating bronchoscope, the bronchoscope was withdrawn up to the carina at intervals to ventilate the contralateral bronchus, before readvancing into the affected bronchus to continue foreign body removal. All patients had rigid bronchoscopy with a ventilating bronchoscope. However, some were done with the aid of a telescope, especially in repeat bronchoscopy, while others had rigid bronchoscopy without the aid of telescopes. Results were presented as simple tables and figures.

**Results**

The study was carried out over a 5 years period, during which 64 patients had foreign body aspiration, but only 18 had bronchoscopy. This shows that 28.1% of foreign body aspiration had bronchoscopy within this study period in our centre. Among the 18 (100%) patients that had bronchoscopy, were 11 males and 7 females (Table 1).

Table 1 shows that there were more males than females. Males made up to 61.1% while females comprised of 38.9% of the patients seen.

Table 2 shows the age distribution of the patients who had bronchoscopy during this study period. The highest rate of bronchoscopy 11(61.0%) was carried out in patients within the 1-5 years age range. 17 patients were aged < 15 years, while 1 patient was older than 15 years.

All our patients had at least one symptom at presentation, and the commonest was cough which was present in 80% of our patients. Other symptoms include, choking, fast breathing, noisy breathing, and fever.

Table 3 shows that majority of the foreign bodies were lodged in the left bronchus in 10 patients, constituting 55.6% of cases. In 8 (44.4%) patients it was in the right bronchus.

Gender	Number of patients	Percentage
Male	11	61.10%
Female	7	38.90%
Total	18	100%

Table 1: Gender distribution of patients.

Age	Number of patients	Percentage
1-5 years	11	61.00%
6-10 years	5	27.80%
11-15 years	1	5.60%
>15 years	1	5.60%
Total	18	100%

Table 2: Age distribution of patients who had bronchoscopy.

Table 4 shows the various objects retrieved on bronchoscopy. Groundnut particles were the highest, which was from 11 (61.0%) patients. This was followed by screw nut and bone, from 2 (11.1%) patients respectively.

In one of our patients with groundnut aspiration, the foreign body went further beyond the right tertiary bronchus, leading to worsening symptoms in the patient due to a right lower lung collapse (Figure 1). The groundnut was however removed piecemeal, and a tracheostomy placed *insitu* for ease of suctioning secretions, and for removing remaining particles of groundnut. One patient with groundnut aspiration died on table after anaesthesia, even before the procedure started, probably from cardiac arrest. This was the only mortality (5.6%) noted in this study.

Among these patients, 2 (11.1%) had repeat bronchoscopy during which the aid of Telescope was employed, while 4 patients (26.7%) had telescopic bronchoscopy *ab initio*.

**Discussion**

This study is a retrospective review of 18 patients who had bronchoscopy in our institution over a period of five years. During this period, among the cases of foreign body aspiration recorded, 28.1% had bronchoscopy. This shows that majority of the foreign body aspirated lodge in the upper airway. Only in few cases did the foreign body succeed in traversing the larynx, to be impacted in the trachea or bronchus. This is similar to the study done in Kaduna, Nigeria by Kirfi et al., who reported that bronchoscopy was done in 26.59% of the cases of foreign body ingestion or aspiration seen in their study [6].

Bronchus	Number of patients	Percentage
Left bronchus	10	55.60%
Right bronchus	8	44.40%
Total	18	100%

Table 3: Location of foreign body.

Objects retrieved	Number of patients	Percentage
Groundnut	11	61.00%
Screw nut	2	11.10%
Bone	2	11.10%
Pencil eraser	1	5.60%
Piece of plastic	1	5.60%
Torch bulb	1	5.60%
Total	18	100%

Table 4: Objects retrieved during bronchoscopy.



Figure 1: X-ray film showing right lung collapse in patient with dislodged bronchial foreign body.

However, they reported less foreign body in the upper airway than in the bronchus, in contrast to our study. Their study which looked at aerodigestive foreign bodies also reported more foreign bodies in the oesophagus (70%) than in the airway (30%), this may be because their study included a large number of adults. Inhaled foreign bodies have been reported to be relatively common in children, especially those aged 1-5 years. This is because their protective throat reflexes are still poor [7] and this invariably makes the rate of bronchoscopy higher in this age group, mostly for the indication of foreign body removal.

It was observed that bronchoscopy was carried out more in males than in females. This can be attributed to males being more adventurous than females, especially during childhood [8]. This makes them more liable to foreign body aspiration [8]. Several studies have also noted more cases of foreign body aspiration in males than females [2-5,7,8]. They also attributed it to an increased activity in the males. However, Farooq et al. in their study, had more females with foreign body aspiration [9] but did not highlight any factor responsible for this finding. Cramer et al. in their study noted that there was no statistically significant difference in the sex predisposition [5].

Farooq et al. noted that foreign body aspiration was more in children aged 1-3 years, and this is responsible for the high rate of bronchoscopy in this age group [9]. This is similar to our findings, where the highest number of bronchoscopy was carried out in children aged 1-5 years. Cramer et al. attributed the risk of foreign body aspiration to the relatively small diameter of the airway in children less than 5 years, added to the molars which are typically absent Before 2 years of age [5]. In addition, this age group explore the world with their mouth, and are very active and easily distracted while eating, making them more prone to foreign body aspiration [5].

In this study, the left bronchus lodged more foreign bodies than the right bronchus (Table 3). This was ascertained by X-ray findings of the patient such as the one seen in Figure 2. However, clinical history and examination were paramount to diagnosis of foreign body aspiration, since some of our cases had X-ray films which did not show foreign body in the airway due to aspiration of radiolucent materials. The studies by Dikensoy et al. [10] and Ezeanolue et al. [4] showed the right bronchus had preferential lodging, similar to Chuan-Shan et al. [7] but these are in contrast to our finding. Similar to this study, Abdulazeez and Iliyasu [11] found a higher lodging of foreign bodies in the left bronchus. Anatomically, it is expected that more foreign bodies should lodge in right bronchus, due to its near vertical alignment with the trachea, as compared to the left bronchus which is more angulated [5,11]. However, this has remained a controversy [11] since some studies like ours, and that done by Abdulazeez and Iliyasu noted the contrary. Therefore, Abdulazeez and Iliyasu concluded that the final location of the foreign body depends on the position of the patient during aspiration [11].

In this study, all our patients who had bronchoscopy presented with cough of various duration, and fever was noted mostly in the cases of groundnut aspiration. Groundnuts have been noted to cause marked inflammatory response and pneumonitis, especially when left for a long period [12]. This is due to their content of arachidonic acid, with unsaturated double bonds in the oil with inflammatory properties [12].

This study also noted history of choking, wheezing and fast breathing. One patient developed right lower lung collapse (Figure 3). After the foreign body went further to the right tertiary bronchus, difficulty in breathing worsened. Out of the 18 patients who had bronchoscopy, five patients had tracheostomy, and in all cases in this

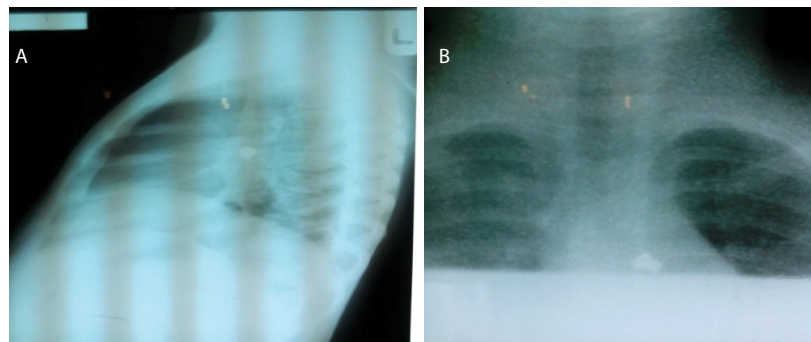


Figure 2: (a and b) Plain X-ray showing screw in left main bronchus of one of the patients.

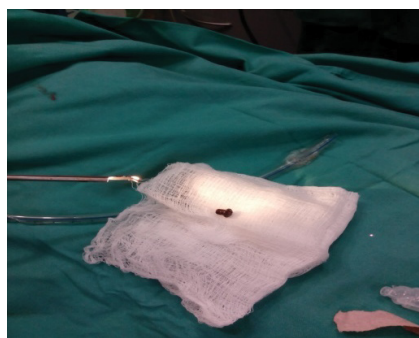


Figure 3: Screw nut removed during bronchoscopy from the patient in above X-ray film.

study antibiotics were given, with good follow up, and they had good recovery.

The most common substance retrieved on bronchoscopy in our study was groundnut particles (Table 4). However other items were also retrieved, like the screw nut shown in Figure 3 and other items such as bone, pencil eraser, and piece of plastic. Groundnut has been noted to be commonest substance retrieved on bronchoscopy, mostly in children less than 3 years [3]. This was similarly noted by Shuan-Chan et al. in China [7] who stated that children cannot chew nuts due to poorly developed chewing function [7]. Ciftci et al. [13] had sunflower seed as its commonest yield, from 75% of their subjects in Turkey, while peas and beans were the commonest in the study done by Farooq et al. in India [9]. However, Ezeanolue et al. in Enugu Nigeria [5] and Abdulazeez and Iliyasu [11] in Kano, Nigeria also noted groundnut as the commonest substance aspirated. Most of these studies that have noted groundnut as the commonest aspirated substance were carried out in Nigeria. This highlights the relatively high prevalence of groundnut aspiration in Nigerian children as against other substances [5]. This calls for greater parent and care giver education as regards the risk of feeding children less than five years with groundnut. The variation in the commonest substance aspirated depends on the location of the study, and predominance of the seed, or preference of the people in that locality. Despite these variations, vegetative foreign bodies have been found to be the commonest yield from bronchoscopy [5,9] especially in children, this was also reported by Kirfi et al [6] as the commonest yield in their study of aerodigestive foreign bodies in Northwest Nigeria.

All the patients in this study had rigid bronchoscopy using rigid ventilating bronchoscopes of appropriate size. The advantage of the rigid bronchoscope over the flexible bronchoscope is its larger lumen which makes it more adaptable to apply various instruments for retrieval of the foreign body [14]. It also has provision for maintaining ventilation during the procedure [14]. Two of our patients had a repeat rigid bronchoscopy, during which telescopes were then employed. Their first attempts failed due to inadequate visualization of foreign body which had disintegrated, and also it was carried out by surgeons who were relatively less acquainted with the use of the bronchoscopes. Ciftci et al. in their study used telescopic bronchoscopy, but they recorded repeat second and third bronchoscopies [13] despite the use of the telescope. This can be attributed to various factors, one of which can be the skill of the surgeon, or the nature of the foreign body. However, no reason was given by the authors for the repeat second and third bronchoscopies. Some studies have recorded very good outcomes with rigid bronchoscopies, even without the use of telescopes [6,7]. In our study, a better outcome and shorter duration of rigid bronchoscopy was noted with the use of telescopes. Falase et al. [3] in their work in Lagos, noted that outcome of bronchoscopy is better with a set of instruments that ensures better vision and this was corroborated in this study. The use of telescopes during bronchoscopy increased the likelihood of complete removal, even in cases where the foreign body disintegrates. This is due to improved illumination and visualization. It also enhanced the procedure time, by speeding up the process of removal with reduced risk of complications [3].

The only mortality recorded in this study was one patient who died due to cardiac arrest, probably as a result of severe prolonged obstruction, or anaesthetic complications leading to cardiac arrest. Ciftci et al. in their study, recorded 5 mortalities from the 563 bronchoscopies with confirmed foreign body aspiration in their study [13,14]. The increased mortality can obviously be attributed to a larger sample size in their study as compared to this study.

## Conclusion

Foreign body aspiration is a life threatening ENT emergency, and bronchoscopy remains the gold standard for management when the foreign body is lodged in the trachea or bronchus. Telescopic bronchoscopy is encouraged for better visualization during procedure, which enhances the ease of removal of the foreign body. However, early presentation and accurate diagnosis are imperative to a good outcome.

## References

1. Adeoti AO, Desalu OO, Fadare OJ, Alaofin W, Onyedum CC (2017) Bronchoscopy in Nigerian clinical practice: A survey of medical doctors' Perception, Use and associated challenges. *Ethiop J Health Sci* 27: 331-338.
2. Onyekwelu FA, Nwosu JN (2010) Bronchoscopy for foreign body removal in children: Anaesthetic challenge in a tertiary hospital. *J College Med* 15: 24-28.
3. Falase B, Sanusi M, Majekodunmi A, Ifeoluwa A, Oke D (2013) Preliminary experience in the management of tracheobronchial foreign bodies in Lagos, Nigeria. *Pan Afr Med J* 15: 31.
4. Ezeanolue BC, Izuora KI, Ezike HA (2003) Tracheobronchial foreign bodies in Nigerian Children: clinical profile and a technique of administering anaesthesia during rigid bronchoscopic removal. *J College Med* 8: 27-29.
5. Cramer N, Tavarez M, Jabbour N, Taylor S (2008) Foreign body aspiration. Statpearls Publishing, Treasure Island, Florida, USA.
6. Kirfi AM, Mohammed GM, Abubakar TS, Labaran AS, Samdi MT, et al. (2014) Clinical profile and management of aerodigestive foreign bodies in North-West Nigeria. *Sudan Med Monitor* 9: 39-43.
7. Chuan-Shan Z, Jian S, Hia-Tao H, Yan S, Jie Q, et al. (2017) Inhaled foreign bodies in paediatric patients: A review and analysis of 3028 cases. *Int J Clin Exp Pathol* 10: 97-104.
8. Okugbo SU, Ugiagbe EE (2013) Outcome of bronchoscopic biopsies in the University of Benin teaching hospital. *Nig Med J* 54: 157-159.
9. Farooq AG, Mohd LW, Shadab NB (2014) Efficacy of rigid bronchoscopy for foreign body aspiration. *Bull Emer Trauma* 2: 52-54.
10. Dikensoy O, Usalan C, Filiz A (2002) Foreign body aspiration: clinical utility of flexible bronchoscopy. *Postgrad Med J* 78: 399-403.
11. Abdulazeez OA, Iliyasu YS (2014) Inhaled foreign body in a paediatric population at AKTH Kano-Nigeria. *Nig Med J* 55: 77-82.
12. Cote CJ, Lerman J, Todres ID (2009) *Otorhinolaryngological procedures in: A practice of Anaesthesia for infants and children*. (4th edn), Saunders Elsevier, 657-683.
13. Ciftci AO, Bingol-Kologlu M, Senocak ME, Tanyel FC, Buyukpamukcu N (2003) Bronchoscopy for evaluation of foreign body aspiration in children. *J Paediatr Surg* 38: 1170-1176.
14. Spiro SG, Silvestri GA, Agusti A (2012) *Bronchoscopy In Clinical Respiratory Medicine*. (4th edn), Saunders Elsevier. p: 947-977.