

Tracheobronchial Foreign Body Inhalation: Experience of 234 Case Series

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Abstract

Background: Foreign body aspiration (FBA) is not an uncommon entity in the population. **Objectives:** In the current study, we discuss our experience in the management of 234 case series with tracheobronchial foreign body removal using bronchoscopy. **Materials and Methods:** The bronchoscopy database (from 2021 to 2022) was reviewed for subjects with a history of FBA managed with bronchoscopy. Demographic, clinical, and bronchoscopy data were collected and analyzed. **Results:** A total of 234 bronchoscopies were carried out for FBA throughout the study period. FBA was more prevalent in children under the age of two (29%) and in patients over the age of ten (24%). In 205 patients, a foreign corpse was found (87.6%). The majority of organic foreign bodies were sunflower seeds (22.4%). Nonetheless, the metallic pins (25.3%) were the most frequent foreign body. The preferred location for the impaction was the right major bronchus (45.9%). Just 90.2% of these individuals had a foreign body. History had an 89.7% sensitivity and a 31% specificity for detecting FBA. Laryngeal edema, which afflicted 32 patients (13.7%), and recurrent chronic chest infection, which affected 13 patients (5.5%), were the most frequent bronchoscopy-related side effects. **Conclusions:** Foreign body inhalation most frequently impacted children aged 1–2 years. The history is a major element in the diagnosis, and bronchoscopy findings were strongly correlated with the patient's history of the incident. The most frequent clinical symptom among individuals who had a proven foreign body but no history of inhalation was protracted pneumonia. The location of the most frequent foreign body lodgment in the tracheobronchial tree depends on the type of foreign body, with metallic pins occurring more commonly in the left main bronchus. Laryngeal edema, which occurred in 13.7% of bronchoscopy patients, was the most frequent complication.

Keywords: Aspiration, bronchoscopy, foreign body, inhalation, tracheobronchial

INTRODUCTION

Foreign body inhalation is a possibly life-threatening medical emergency that arises when an object enters the tracheobronchial tree. This can lead to airway obstruction, infection, and even death if not treated promptly. According to a study published in the *Journal of Thoracic Disease*, foreign body inhalation is most common in children under the age of three, though, adults can also be affected.^[1,2] Generally, patients may exhibit respiratory distress necessitating prompt management or with recently developed respiratory symptoms such as shortness of breath, wheezing, and productive cough. Particularly in patients who present without a history of aspiration, the recognition of foreign body aspiration necessitates a high degree of clinical suspicion. An unrelated chest radiograph

or one taken during a bronchoscopy may occasionally reveal a forgotten foreign body.^[3]

Identification of foreign body aspiration is made according to clinical presentation, imaging studies (such as chest X-ray and CT scans), and bronchoscopy, which is the most effective way to visualize and remove the foreign object.^[3,4] The radiological symptoms of foreign body inhalation, particularly in individuals with organic foreign bodies, include non-resolving pneumonia, asymmetrical hyperinflation, atelectasis, or localized bronchiectasis.

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Direct viewing of the foreign body is possible in cases of radiopaque foreign bodies.^[5] A foreign body may be directly visible during bronchoscopy, or it may be hidden by granulation tissue, edema, or endobronchial stenosis—all signs of a tissue reaction to an inhaled foreign material. Because it can secure the airway, rigid bronchoscopy is preferred for foreign body removal in children, but flexible bronchoscopy can be used for both diagnosis confirmation and foreign body removal in adults.^[6] Foreign bodies also deposit in the proximal tracheobronchial tree in children, which is accessible with a rigid bronchoscope, but in adults, they lodge in the distal tracheobronchial tree.^[3]

Treatment usually involves bronchoscopy to remove the object, although in some cases, surgical intervention may be necessary. Complications such as infection or lung collapse may occur and require additional treatment.^[3,4]

In the current study, we discuss our experience in the management of 234 case series with tracheobronchial foreign body inhalation.

MATERIALS AND METHODS

Patients and study design

This was a retrospective study of 234 cases who had been admitted to Al-Imamain teaching hospital, Baghdad, from February 2021 to January 2023. Those patients had been admitted because of the suspected inhalation of foreign bodies. They had been grouped according to age, sex, and geographical distribution. They had been divided into those with a suspicious or definite history of foreign body aspiration and those with no such history.

All the patients had been subjected to a complete clinical evaluation. Chest X-ray did in 231 patients. Some patients were considered emergencies and bronchoscopy was performed after preparation of the patients except those who presented with stridor or respiratory distress was endoscoped immediately.

Before induction of the anesthesia, a suitable size venous line was very essential. The most suitable-sized bronchoscope was then selected together with the grasping forceps and proper suckers are prepared and checked.

The procedures were carried out under general anesthesia using a rigid bronchoscope with calibers chosen according to the size and age of the patient. Throughout the process, the patient's vital signs were monitored until they returned to spontaneous breathing and consciousness. The vast majority of children tolerated the procedure very well.

Types, sites of foreign body lodgment, and other bronchoscopic findings were recorded in addition to complications. After completion of the procedure, most patients were nursed in an oxygen mask with a continued antibiotic. The steroid was given routinely to those patients with laryngeal edema. 24 h following

the procedure, the majority were able to leave the hospital.

Five cases had been scheduled to undergo thoracotomy because the foreign body had been impacted and could not be removed by rigid bronchoscopy.

The diameter of the bronchoscope (for children under the age of six) is equal to the age in years plus 3.5/3. Whereas the bronchoscopic size for those older than 6 years was equal to the age in years + 4.5/4.

Ethical consideration

The Ethical Committee of Al-Nahrain University, Iraq, examined and approved the study protocol and patient permission forms under reference number BMS 533/016 on April 11, 2022. The entire study protocol was completed according to the principles of the Helsinki Declaration.

Statistical analyses

The statistical analysis included descriptive data using number and percentages. The data were collected, processed, and transferred to Word Excel sheet, using Windows 19. The frequencies and percentages were used for nominal parameters. The data were processed and analyzed by using computer software statistical package for social science (SPSS) version 25 (SPSS, IBM Company, Chicago, IL, USA).

Data availability

The data associated with this paper are available on reasonable request from the corresponding author.

RESULTS

The patients had been grouped according to age, which ranged from 6 months to 28 years. Foreign body inhalation was more common in ages less than 2 years (29%), followed by those more than 10 years (24%). 72% of the patients were from an urban area and 28% from a rural area. The ratio of female-to-male cases of foreign body inhalation was 1.2:1. Foreign body was found in 205 patients (87.6%) and no foreign body was detected in the remaining [Table 1].

Organic foreign bodies were present in 54.1% and the most common organic body was sunflower seeds (22.4%). However, the most common foreign body in the current study was the metallic pins (25.3%) [Table 2].

The right main bronchus is still the preferred site for the impaction (45.9%) followed by the left one (33.7%). The preferred site for the lodgment of the metallic pin was the left main bronchus (82.7%) followed by the right one (96%) [Table 3].

Out of the 234 patients, 204 patients (87%) in this study had a confirmed or possible history of inhaling a foreign

Table 1: Age distribution among patients with foreign body inhalation

Variables	No. (%)
Age	Range 6 months to 28 years
Age groups	<2 years 68 (29)
	2–4 years 47 (20)
	4–6 years 31 (13.2)
	6–8 years 14 (6)
	8–10 years 17 (7.2)
	>10 years 57 (24.3)
Residency	Urban 168 (72)
	Rural 66 (28)
Gender	Females 126 (54)
	Males 108 (46)
	Females/males ratio 1.2:1
Bronchoscopy results	Positive 180 (87.6)
	Negative 25 (12.4)

Table 2: Types of inhaled foreign body (N=205)

Types of foreign body	No (%)
Organic foreign bodies N = 111 (54.1%)	
Sunflower seed	46 (22.4)
Watermelon seed	25 (12.2)
Peanut	13 (6.3)
Other seeds (Orange, pomegranate, bean, rice, bread)	27 (13.2)
Non organic N = 94 (45.9%)	
Metallic pin	52 (25.3)
Pieces of plastic, rubber	29 (14.1)
Other metallic pieces	13 (6.3)

body. In these patients, the foreign body was found in 90.2% only. In contrast, 30 patients (13%) had no such history. In these patients, the foreign body was found in only 70%. So, the sensitivity of history for the detection of foreign body inhalation was 89.7% and the specificity was 31%. The positive likelihood ratio (+ve) is 1.3, whereas the negative likelihood ratio (–ve) is 0.33 [Table 4].

In 231 cases, X-rays were taken; however, in three patients, the condition was so critical that no time was available to capture a radiological film [Table 5].

The most frequent bronchoscopy-related consequences were laryngeal edema, which affected 32 (13.7%) patients, and recurrent chronic chest infection, which affected 13 (5.5%) patients [Table 6].

DISCUSSION

In our country, foreign body inhalation is still a prevalent condition, and there are numerous diagnostic and therapeutic challenges. Radiologic results, clinical examination, and history are typically used to confirm the final diagnosis. The failure to consider the significance of describing historical data, misinterpreting the diagnosis

Table 3: Distribution of tracheobronchial foreign bodies according to the site of impaction

Site of impaction	Number (%) and types of foreign bodies
Rt. main bronchus	94 (45.9)
	Sunflower seed 33 (16.1)
	Watermelon seed 15 (7.3)
	Peanut 11 (5.4)
	Metallic pin 5 (2.4)
	Others 30 (14.6)
Lt. main bronchus	69 (33.7)
	Metallic pin 43 (20.9)
	Sunflower seed 5 (2.4)
	Watermelon seed 3 (1.5)
	Peanut 1 (0.5)
	Others 17 (8.3)
Trachea	31 (15.1)
	Sunflower seed 6 (2.9)
	Watermelon seed 5 (2.4)
	Peanut 1 (0.5)
	Metallic pin 4 (1.9)
	Others 15 (7.3)
Subglottis	11 (5.4)
	Sunflower seed 2 (0.9)
	Watermelon seed 2 (0)
	Peanut 0
	Metallic pin 0
	Others 7 (3.4)
Total	205

Table 4: The relation between history of inhalation and bronchoscopy results

History of foreign body impaction	No (%) of patients	Bronchoscopy result	No (%)
Positive	204 (87)	+ve	184 (90.2)
		–ve	20 (9.8)
Negative	30 (13)	+ve	21 (70)
		–ve	9 (30)

with other frequent illnesses, and focusing entirely on normal radiographic pictures are some of the causes of diagnostic delay. Any person who has been in contact with the child must be questioned to determine any history of suffocating, choking, or coughing that may have received little attention or been missed by older people. Whenever these symptoms appear, the situation should be treated as one of the foreign body inhalations, necessitating a bronchoscopic operation.

In our study, the most common age group affected by foreign body inhalation was those who were less than 2 years (29%) followed by those who were more than 10 years (24.3%) and this goes with the result found in a recent study conducted in a tertiary Syrian center.^[7]

In our study, the female-to-male ratio was 1.2: 1 similar to that published by recent studies, one in Syria^[7] and the second in Iraq.^[8] The most common inhaled foreign body in the current study was the metallic pin (25.3%) followed

by sunflower seed (22.4%) and watermelon seed (12.2%) and again this differs from the result found in a local study where the most common foreign body inhaled was the watermelon seed (49.4%).^[8]

Although male children are overactive as compared with female children and thus more vulnerable to foreign body inhalation, in our study female children were more commonly affected than male children. This might be clarified by the high frequency of metallic pin inhalation among female children. This is due to bad habits among

female children as they handle the pin by their mouth during wearing a veil. And this also explains the great difference between this study and another Iraqi study as the most common inhaled foreign body in this study was the metallic pin and the society became more religious than before.

The majority of the patients were from urban areas (72%) as compared with 28% from rural areas. And this is inconsistent with the result found in a prior Iraqi study

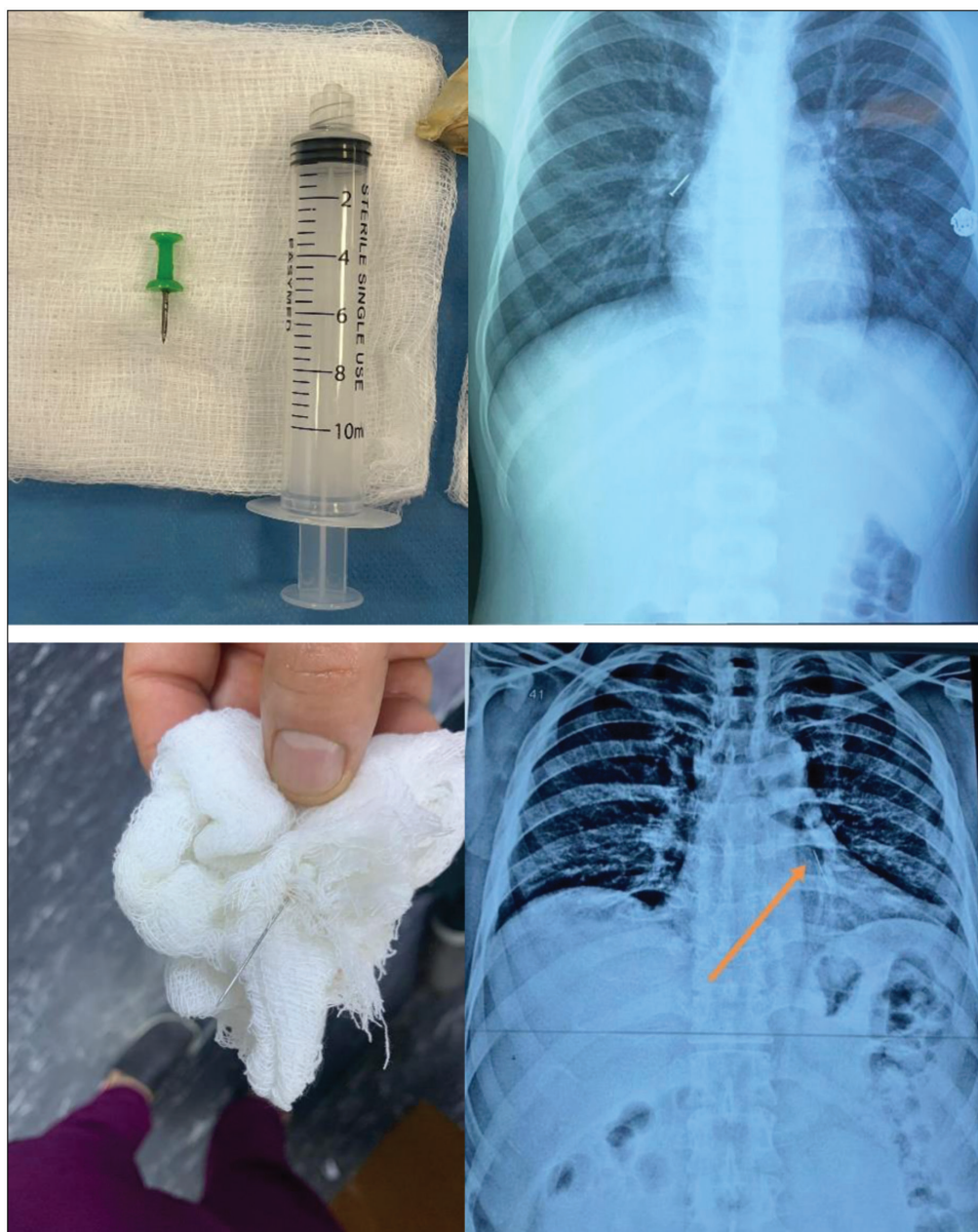


Table 5: The X-ray radiological findings of the cases with tracheobronchial foreign body inhalation

Radiological finding	No (%)
Normal	122 (52.8)
Radiopaque	65 (28.1)
Pneumonia	25 (10.8)
Atelectasis	12 (5.1)
Emphysema	6 (2.5)
Bronchiectasis	1 (0.4)
Total	231

published by Abdulameer where 47% were from urban areas.^[9]

The primary factor in the diagnosis of foreign body inhalation is history concordant to several earlier studies (92.8%, 80.9%).^[7,8] Contradictory results have been published currently revealing a positive history only in 17% of patients with inhaled foreign bodies.^[10] The 204 of the 234 patients in this study (87%) had a confirmed or potential history of inhaling a foreign body, whereas the remaining patients (13%) did not. A foreign body was detected by bronchoscopy in 184 patients (90.2%) whereas in 20 patients (9.8 %) no foreign body was found despite suggestive histories. In contrast, bronchoscopy was positive for the presence of foreign bodies in 21 patients (70 %) out of 30 patients in whom such a history was not obtained.

In both Mohsen's^[7] and Abdulameer's^[9] studies, the foreign body was detected in (82.4% & 81.9%), respectively, of the patients with a definite or suspicious history of foreign body inhalation but only 31.1% with no such history were proved to have foreign body inhalation. However, Elhassani^[11] was able to detect foreign bodies in all those patients with a definite history of inhalation, and in 73.16% with a negative history.

Before a bronchoscopy, a chest X-ray should be acquired. No matter how many X-Ray films have been taken, a final one must be taken right before the bronchoscopy to confirm the existence and location of the foreign body.

In this study (52.8%) showed no abnormalities in their chest radiograph. This figure is inconsistent with that obtained by the Mohsen study (79.5%)^[7] and Elhassani (65.8%).^[11] The next most common finding was a radiopaque foreign body (28.1%). This was inconsistent with the Mohsen study (3.29%) and Elhassani study (3.4%).^[7,11]

Many organic foreign bodies, such as bones and plants/meat, are radiolucent even under chest CT scan,^[10] even though it is more sensitive than X-rays to detect radiopaque foreign bodies.^[12,13] During inspiration and expiration, physicians should also take lateral and anterior-posterior radiographs. Although radiographs did not display radiolucent foreign bodies, such as plastic, aluminum, glass, or organic things; air trapping and atelectasis are

Table 6: Types of complications in patients with foreign body inhalation

Complications	No (%)
Immediate complication	
Cardiopulmonary arrest	1 (0.4)
Pneumothorax	2 (0.8)
Late complication	
Recurrent persistent chest infection	13 (5.5)
Atelectasis	3 (12)
Tracheoesophageal fistula	1 (0.4)
Bronchiectasis	1 (0.4)
Bronchoscopy related complications	
Laryngeal edema	32 (13.7)
Cardiac arrest	2 (0.8)
Pneumothorax	1 (0.4)

good radiographic findings. Nonetheless, the obtained lesson was the foreign body may still be present even if results from the physical examination and radiography are inconclusive.^[14]

The most frequent location for the lodging of inhaled foreign bodies was found to be the right main bronchus (45.9%), which is less than the result of another Iraqi study (55.2%). However, comparable outcomes were also published by other cardiothoracic surgeons.^[2,5,7,10] The left main bronchus was found to be the site for lodgment of inhaled foreign bodies (33.65%) which is lower than that reported by the Syrian,^[7] and a local study (26.2%).^[9] Tracheal foreign bodies were seen in 10.1% which is a little bit higher than that obtained by the Mohsen study (9.3%).^[7] Regarding the impaction in subglottic space (5.4 %), it was almost close to the result of prior articles.^[15] The pediatric airway is most narrowed in the subglottic region, and foreign objects can lead to airway edema, which reduces the airway's diameter even further.^[16]

The author has observed that impaction and lodgment were most frequently found in the right main bronchus. This was mostly due to its larger diameter, lesser angle of tracheal axis deviation, location of the carina, which was often to the left of the midline, and the larger amount of air reaching the right lung during inspiration.^[2]

Even though the right main bronchus was the favored location for foreign body lodgment, the metallic pin was removed from the left main bronchus more frequently (82.7%) than the right main bronchus (9.6%).

The preferred approach for removing all tracheobronchial foreign bodies is bronchoscopy. The rigid optic bronchoscope allows excellent visualization of the tracheobronchial lumen and facilitates the use of biopsy forceps to remove the foreign body.

The procedures were carried out under general anesthesia using a rigid bronchoscope with calibers chosen according to the size and age of the patient. Throughout the process,

the patient's vital signs were monitored until they resumed spontaneous breathing and wakefulness. The vast majority of children tolerated the procedure very well. After completion of the procedure, most patients were nursed in an oxygen mask with a continued antibiotic. The steroid was given routinely to those patients with laryngeal edema. 24 hours following the procedure, the majority were able to leave the hospital.

Five patients had been scheduled to undergo thoracotomy because the foreign body had been impacted and could not be removed by rigid bronchoscopy.

Various degrees of post-bronchoscopy stridor due to laryngeal edema occurred in 13.7%. Successful treatment of this problem is by administration of oxygen and steroids.

Cardiac arrest occurred in 3 patients 1.2%. Failure of resuscitation occurred in 2 patients. Cardiac arrest may be due to hypoxia mainly due to prolong procedures, anesthetic drugs side effects mainly suxamethonium, and vagal overstimulation. Complications resulting from delayed diagnosis and subsequent mismanagement included recurrent chest infection in 5.5%, atelectasis in 1.2%, bronchiectasis in 0.4%, and tracheoesophageal fistula in 0.4%.

Early diagnosis, prompt consideration of bronchoscopy, and unit setup are all factors that contribute to positive outcomes. The pattern of presentation and the likelihood of foreign body inhalation should be familiar to the doctors. Every patient with a protracted chest infection should be suspected of having an inhaled foreign body.

The limitations of this study included the following points. The sample size is a significant limitation in the current case series. Given that statistical tests often necessitate a larger sample size to assure a reasonable demographic distribution, the small sample size makes it challenging to identify meaningful associations from the data. The absence of accessible and/or trustworthy data restricts the span of our study, and the size of the sample, or may pose a serious challenge to the detection of significant relationships.

CONCLUSION

Foreign body inhalation most frequently impacted children aged 1–2 years. The history is a major element in the diagnosis of foreign body inhalation, and bronchoscopy findings were strongly correlated with the patient's history of the incident. A bronchoscopy is justified by even the slightest doubt of inhaling a foreign body; a negative bronchoscopy is significantly preferable to leaving an inhaled foreign body with eventual consequences. The most frequent clinical symptom

among individuals who had a proven foreign body but no history of inhalation was protracted pneumonia. The location of the most frequent foreign body lodgment in the tracheobronchial tree depends on the type of foreign body, with metallic pins occurring more commonly in the left main bronchus. Laryngeal edema, which occurred in 13.7% of bronchoscopy patients, was the most frequent complication.

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Conflicts of interest

There are no conflicts of interest.

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