



# Foreign body aspiration in children at University of Gondar Comprehensive Specialized Hospital, a two year retrospective study

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## ABSTRACT

**Introduction:** Foreign body aspiration (FBA) is defined as asphyxia, suffocation, or inhalation of items of food, such as bone and seed, and non-food, such as toys, into the respiratory tract. Aspiration of foreign bodies is an important and preventable cause of mortality and morbidity in children, especially those less than 3 years of age. The aim of this study was to analyse the clinical and radiological profile, modes of management, and outcomes of foreign body aspiration in children at the University of Gondar Comprehensive Specialized Hospital and identify areas of possible interventions for proper management of such cases.

**Method:** A retrospective review of the medical records of all patients suspected of foreign body aspiration at the University of Gondar Comprehensive Specialized Hospital (UoGCSH) from January 1, 2021, to January 1, 2023, G.C. was conducted. Clinico-radiological features, types and locations of foreign bodies, modes of management, and patient outcomes were studied.

**Results:** A total of 73 patients suspected of having a possible foreign body aspiration were identified. The median age of the patients was 24 months, with an IQR of 14 and 39, with 46 (75.3 %) being under 3 years of age. 45 (61.6 %) were male, while 28 (38.4 %) were female, making the M:F ratio 1.6:1. A foreign body aspiration history could be obtained in 68 (93.1 %) of the patients, while in 4 (5.9 %) of the cases, patients or their families were not aware of any kind of aspiration. Among the children presented, 65 (89 %) had a choking episode, coughing 66 (91 %), vomiting 63 (86.3 %), tachypnea 61 (83.6 %), and stridor 15 (20.5 %). The most common physical finding observed was nasal flaring along with subcostal and intercostal retraction in 59 (80.8 %), followed by decreased air entry in 40 (54.8 %), wheeze in 37 (50.7 %), and absent air entry in the affected side in 4 (5.5 %) of the patients. A chest x-ray was done on all patients. 28 (41.2 %) had normal chest x-rays. With regard to procedure-related complications, 3 (4.1 %) patients had cardiac arrest, 1 (1.36 %) had pneumothorax, and 1 patient died.

**Conclusion:** Any bronchopulmonary infection with an unusual course should be suspected of being the result of the aspiration of a foreign body. Increased public and professional awareness of the importance of early bronchoscopy in all suspected cases of foreign body aspiration is necessary. In order to lower the incidence, those providing care must be taught routine preventive measures.

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## 1. Introduction

Pediatric foreign body aspiration is a significant and potentially life-threatening problem worldwide. Over the three years from 2009 to 2011 in the United States, an estimated 1908 kids with foreign body aspiration were hospitalized each year [1]. When a caregiver observes an aspiration incident or choking episode in a child, the child is frequently examined for foreign bodies. Unfortunately, the aspiration event is not always witnessed, and a trustworthy witness is not always available. Children who aspirate foreign objects run the risk of serious illness and fatality. Sometimes the diagnosis is difficult to make, which delays presentation and treatment [2–4].

If there is no related history, a high level of suspicion is required to diagnose foreign body aspiration. The final treatment to rule out a foreign body is a bronchoscopy because X-rays can occasionally be ambiguous. Missed foreign bodies can easily be misdiagnosed as having other chronic respiratory illnesses when they subsequently show with chronic illness and a variety of symptoms [5,6]. The risk of unintentional foreign body aspiration is greater in younger children. Younger children are more likely to put small things in their mouths, which has been linked to an increase in occurrence. They are also more likely to yell, shout, run, and play while carrying objects in their mouths, and they lack the molars necessary to chew some foods properly. Fewer than 15 % of children older than 5 years old experience foreign body aspirations, according to the majority of studies [7].

Foreign body aspiration typically appears as an unnoticed episode, thus the surgeon must have a high index of suspicion even in the absence of a favorable medical history in order to avoid morbidity and mortality from delayed or incorrect diagnosis. In the majority of instances, the classic triad of bronchial foreign body symptoms—sudden onset cough, wheezing, and reduced breath sounds on the afflicted side—is present. Children suffer from a high rate of morbidity and mortality due to tracheo-bronchial foreign body aspiration, with children under 3 years old experiencing the highest incidence. Clinical symptoms, chest radiography, and physical examination become crucial tools in such situations to assist doctors in determining which kids should have a bronchoscopy. Rigid bronchoscopy is required for the location and removal of the aspirated foreign body as the gold standard treatment for FBA that has been diagnosed [8–12]. The complications of FBA can be divided in two groups: complications related to the foreign body itself and complications following the bronchoscopic procedure [13]. Since young children are exposed to seeds in their surroundings, which are particularly prevalent in Ethiopia, foreign body aspiration is a serious concern for their health and wellbeing. To prevent such situations, education, awareness, and parental supervision are necessary. According to one study done in Ethiopia, the mean age of patients presented with foreign body aspiration was 4.6 years and the most commonly aspirated objects were plastic tips (22 %) followed by seeds (19 %) [14]. The purpose of the current study is to determine the magnitude, type of foreign body, complications and treatment outcome of children treated for foreign body aspiration at University of Gondar Comprehensive Specialized Hospital. Last but not least, the results of this study have significant ramifications for policymakers, clinical practitioners, and parents at large.

## 2. Methods and material

### 2.1. Study design, setting and population

A retrospective review of medical records of all patients suspected of foreign body aspiration at University of Gondar Comprehensive Specialized Hospital (UoGCSH) from January 1, 2021 to January 1, 2023 G C was conducted. The hospital is found in Gondar town of Amhara regional state, which is located 743 km northwest of the capital Addis Ababa, Ethiopia, and it serves Gondar and surrounding zones. According to the 2015 report of the central statistical agency of Ethiopia, Gondar has a population of 323,900 [15]. The town has one public comprehensive specialized hospital, which is one of the oldest teaching hospitals in the country and provides health services for more than 7 million people in Gondar town and surrounding catchment areas [16]. Gondar University Hospital is the only place where rigid bronchoscopy is done in Amhara regional state.

### 2.2. Data collection

The clinical data were collected using a data extraction sheet from the patient's medical charts. Data on sociodemographic traits, clinical conditions, intraoperative findings and complications and patient outcome were gathered.

### 2.3. Data processing and analysis

The data were checked for inconsistencies, coding error, completeness, clarity, and missing values before they were entered. The data were entered using EPI DATA 3.1 version and exported to the IBM SPSS Statistics 25 statistical software for further data cleaning and statistical analysis. Descriptive statistical analysis such as frequency, percentage, cross tabulation, median, and Interquartile range (IQR) were performed.

## 3. Results

A total of 73 patients suspected of having a possible foreign body aspiration were identified. There was no foreign body in five of them, and they were excluded from the analysis. The median age of the patients was 24 months, with an IQR of 14 and 39, with 46 (75.3 %) being under 3 years of age. 45 (61.6 %) were male, while 28 (38.4 %) were female, making the M:F ratio 1.6:1. A foreign body

aspiration history could be obtained in 68 (93.1 %) of the 66 patients who had foreign bodies upon bronchoscopic evaluation, while in 5 (6.8 %) of the cases, patients or their families were not aware of any kind of aspiration. Of these 2 patients, one had foreign bodies upon bronchoscopic evaluation. The time interval between aspiration and admission to our unit ranged between 1 h and 2 months, with a mean of  $5.35 \pm 1.6$  days. 17 (23.3 %) of the patients were referred from other parts of the region (up to 500 km away). Among the children presented, 65 (89 %) had a choking episode, coughing 66 (91 %), vomiting 63 (86.3 %), tachypnea 61 (83.6), and stridor 15 (20.5 %). The most common physical finding observed was nasal flaring along with subcostal and intercostal retraction in 59 (80.8 %), followed by decreased air entry in 40 (54.8 %), wheeze in 37 (50.7 %), and absent air entry in the affected side in 4 (5.5 %) of the patients (Table 1). A chest x-ray was done on all patients. Among them, 21 (31 %) of the patients had signs suggestive of pneumonia; 8 (11.8 %) patients had contralateral hyperinflation (Figure one); 4 (5.8 %) patients had atelectasis (see Figs. 1 and 2); 3 (4.4 %) patients had pneumonia with atelectasis; 2 (3 %) had radiopaque foreign body patients; and 2 (3 %) had pneumothorax. 28 (41.2 %) had normal chest x-rays.

All the patients were scoped under general anesthesia using a rigid bronchoscope, which has only one port; the most commonly retrieved foreign body was soybean 14 (19.2 %), pea 12 (16.4), corn 12 (16.4 %), serkin seed 7 (9.6 %), and coffee bean 6 (8.2 %) (Table 2). The most common airway site where foreign bodies were encountered during the bronchoscopic procedure was in the right main bronchus in 45 (61.6 %), followed by the left main bronchus in 12 (16.4 %), the trachea in 7 (9.6 %), and the lower bronchus in 3 (4.1 %). With regard to procedure-related complications, 3 (4.1 %) patients had cardiac arrest, 1 (1.36 %) had pneumothorax, and 1 patient died (Table 3).

#### 4. Discussion

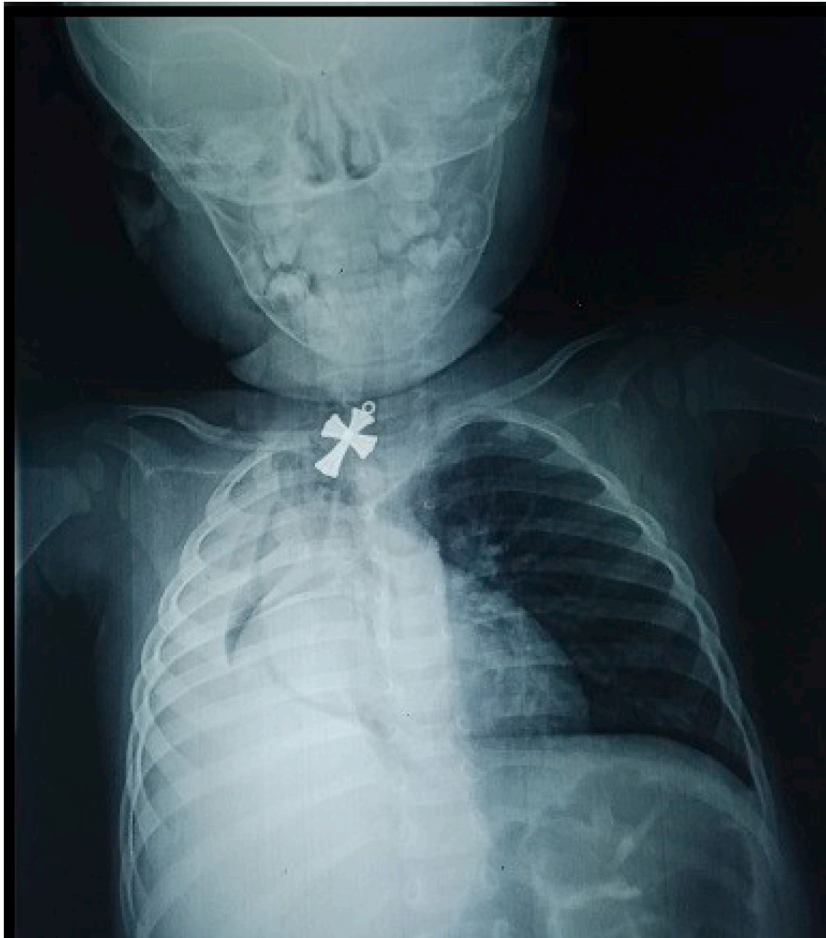
Foreign body aspiration (FBA) is defined as asphyxia, suffocation, or inhalation of items of food, such as bone and seed, and non-food, such as toys, into the respiratory tract. Foreign body aspiration is a significant and curable cause of mortality and morbidity in children, particularly those under the age of three. In both high- and low-income nations, this issue continues to lead to severe problems, even fatalities [8]. The aim of the our study was to determine type of foreign body, complications and treatment outcome of children treated for foreign body aspiration at our institution, based on our findings the most commonly aspirated objects were seeds (soybean, pea and corn) with mean age at presentation of 24 months and 75 % of the children were under the age of 3 which is consistent with other studies. Unlike our findings, in a study done in Ethiopia, the most commonly aspirated object was plastic tips and the mean age at presentation was also 4.6 years which higher than our finding [14]. The reason may be children in our area, are constantly exposed to roasted seeds because they are frequently eaten with meals. Wild seeds are also widely available in areas where kids are exposed to them frequently. According to English language literature, pebbles, plastic, and wooden or metal objects are aspirated significantly less commonly than nuts and vegetables, which together make up around 80 % of aspirated foreign bodies [17]. Throughout our region, seeds and plant seeds were the most frequently aspirated objects. Seeds, notably watermelon and sunflower seeds, are the most frequently aspirated objects throughout the Middle East. One of the most frequent causes of morbidity and mortality in children is FBA, particularly in the first 3–4 years of life (our findings also indicated that the majority of the children are under the age of 3). According to the National Safety Council, there were 180 children who died in the USA in 1994 as a result of FBA. The Italian National Institute of Statistics reports that 28 children passed away from FBA in 1999 [18]. According a recent study done in Romania, among children presented with foreign body aspiration, majority (86 %) were under the age of 3 and the most commonly aspirated objects were organic foreign body such as seeds. The most commonly observe x-ray finding was pulmonary atelectasis, unlike our finding, pneumonia [19]. The high rate of foreign body aspiration in younger patients can be attributed to a number of factors, including immaturity of the swallowing mechanism, narrow upper airways, young children's natural curiosity that manifests itself in putting new things in their mouths, and an immature mastication system. Boys may have a higher rate of foreign body aspiration due to their more active activities [20].

Some of the risk factors include shouting, talking, playing, running, weeping, and laughing while eating, as well as parental

**Table 1**  
Clinical presentation of patients presented with foreign body aspiration.

Symptoms	Frequency (n = 73) Percentage (%)
Cough	67 (91.8)
Choking episode	65 (89)
Shortness of breath	44 (63.3)
Vomiting	63 (86.3)
Fast breathing	61 (83.6)
Stridor	15 (20.5)
Grunting	11 (15.1)
Other symptoms (like LOC)	3 (4.1)
<b>Signs</b>	
SC/IC retraction and nasal flaring	58 (80.8)
Decreased air entry	40 (54.8)
wheeze	37 (50.7)
Absent air entry	4 (5.5)
Others (criptations, ronchi etc)	8 (11)

LOC: loss of consciousness.

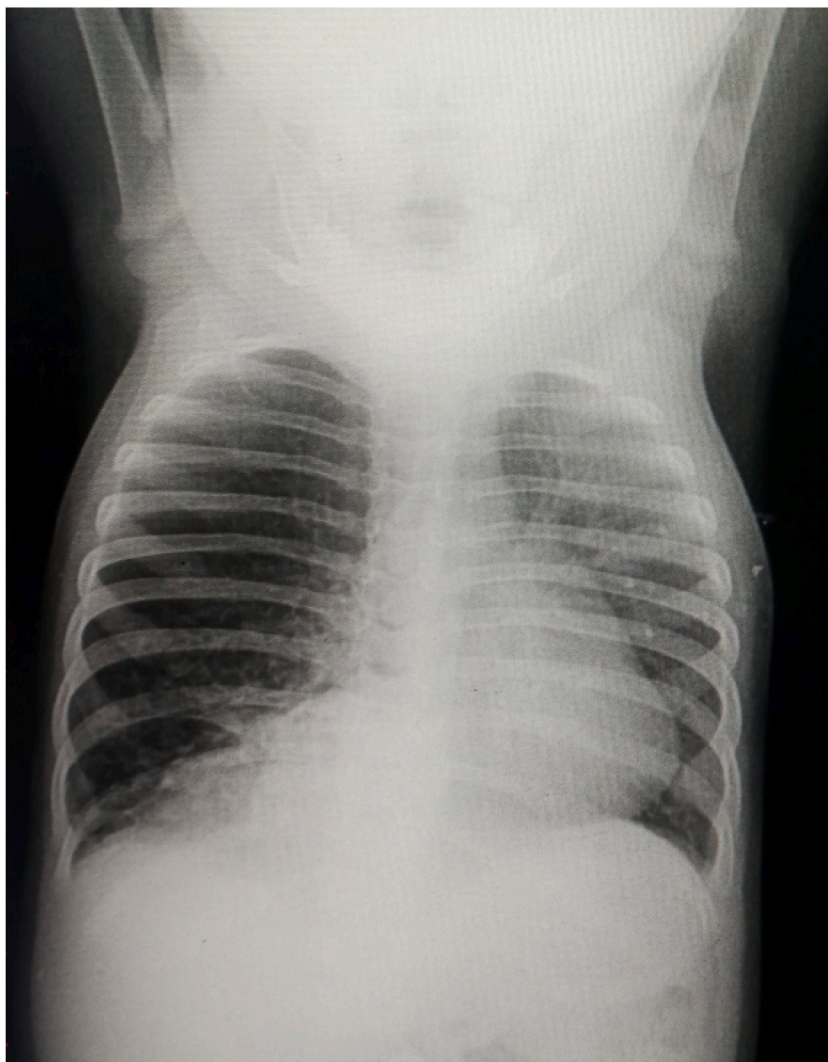


**Fig. 1.** Chest x-ray of a 12 month old female child with foreign body aspiration showing right side lung collapse with ipsilateral mediastinal shift and contralateral lung hyperinflation.

misunderstanding of the risks of foreign body aspiration. Children in our nation, especially in our region, are frequently exposed to roasted seeds, which are typically consumed as part of meals. Where children are exposed regularly, wild seeds are also abundantly available. Additionally, one of the risk factors for children is parental awareness of the harmful effects of foreign body aspiration. These parents don't appear to be aware that these seeds can be harmful to youngsters. The most commonly aspirated foreign body is a peanut in more advanced western countries whereas beans and peas are the most common in our area [21–25]. The spot where the foreign body will be situated depends on the size, shape, and surface of the inhaled foreign body as well as the patient's anatomical condition [26,27]. The key to diagnosing FBA is the patient's medical history. The most typical FBA presentation is choking followed by an intense episode of coughing. When the presentation is delayed and the history is uncertain, the yield of physical examination and radiological investigations in the diagnosis of FBA is increased. Therefore, bronchoscopy should be done if FBA is suspected. On the other hand, with a negative or questionable history, adequate radiographic and physical findings should initiate bronchoscopy [28].

The primary investigative technique in FBA is a plain chest X-ray. According to published data, patients with FBA have rates of unilateral or localized hyperlucency, localized atelectasis, and pneumonia that are, respectively, 17.1–63 %, 8–40.9 %, and 0–20.2 %. in our study, pneumonia and atelectasis were seen in 36 % and 7 % of the patients respectively [29]. A radioopaque foreign material, mediastinal shift, obstructive emphysema, collapse, or consolidation are frequently seen on conventional X-rays of the chest. A negative radiograph does not, however, eliminate the possibility of a diagnosis of foreign body aspiration [30]. Radioopaque foreign body was seen only in two patients. Foreign body aspiration (FBA) is a dangerous condition that frequently occurs in pediatric emergency rooms. The issue for the clinician is that a standard chest radiograph, physical examination, and anamnesis are not sensitive enough to rule out an FB in the respiratory tract. For any FBA suspicion, it is typically advised to perform a rigid bronchoscopy, which allows for simultaneous diagnosis and treatment, if necessary. However, rigid bronchoscopy (RB) in emergency situations carries a 4–17 % risk of consequences, with 14 % of patients without FB especially at risk (for example, desaturation, bronchospasm, airway damage, pneumothorax, respiratory arrest, etc.). According to our finding, the prevalence of procedure associated complication including death is 6 %. Flexible bronchoscopy is being used by some, but its implementation under local anesthesia is still risky for the concerned population and necessitates the presence of an anesthesiologist; it is more of an alternative to RB in the operating theater,





**Fig. 2.** AP chest x-ray of a 2 year old female child with foreign body aspiration showing obliteration of right heart border and right hemidiaphragm suggestive of right-side middle and lower lung lobe collapse.

**Table 2**  
The type of foreign bodies identified upon bronchoscopic evaluation.

Type of foreign material	Frequency(n = 68) percentage
Soybean	14 (20.5)
Pea	12 (16.4)
Corn	12 (16.4)
Ximenia americana	8 (11.7)
Coffee bean	6 (8.2)
Pen cup	4 (5.8)
Gravel	2 (2.7)
Cordia Africana seed	2 (2.7)
Garlic fragment	2 (2.7)
Popcorn	1 (1.4)
Fruit seeds	1 (1.4)
Others (grass, unspecified seed)	4 (5.5)

and some people speak of flexible tool extractions. Determining which patients—whether for a flexible or RB—should visit the operating room is still a challenge [31,32].

The majority of times when foreign bodies are inhaled, there is a clear history of choking, followed by paroxysmal coughing that

**Table 3**  
Complication observed among patients presented with foreign body aspiration.

Complications related to the foreign body	Frequency (n = 73) percentage
Pneumonia	21 (31 %)
Hyperinflation	8(11.8 %)
Atelectasis	4 (5.8 %)
Pneumonia with atelectasis	3 (4.4 %)
pneumothorax	2 (3 %)
Procedure related complications	
Cardiac arrest	3 (4.1 %)
Pneumothorax	1 (1.4 %)
Death	1 (1.4 %)

gradually goes away. The asymptomatic period that follows is what causes the delay in diagnosis. In the majority of cases, the trio of symptoms—choking, coughing, and unilateral wheeze—is present. Fortunately, acute respiratory distress from inhaled foreign bodies is rare, but it presents in a particularly worrisome way [33]. In particular for asymptomatic patients, the use of CT-scan with multi-planar reconstruction in suspected foreign body aspiration is a reliable substitute for endoscopy under general anesthesia, preventing excessively negative endoscopies [31]. The likelihood of a local perfusion deficit is higher when a foreign body is present in the air for more than seven days before removal. A three-day foreign body experiment in an animal investigation resulted in local histologic alterations without radiologic proof. When the foreign body was left in place for longer than 30 days, fibrosis and bronchial dilatations developed as a complication [34]. The most common complication observed was pneumonia in our patients.

## 5. Strength and limitation of the study

This study has its strengths and limitations. The strength of this study is that it is the first to assess the management outcome of children with foreign body aspiration at UoGCSH. However, the limitations of this study were incomplete documentation, single-center design, and retrospective design.

## 6. Conclusion

If a child has a history of choking or if their pneumonia is not improving after receiving the recommended treatment, especially if they were previously healthy, it is important to rule out aspiration of a foreign body. Radiographs don't help much in ruling out a diagnosis. However, they are crucial in order to identify a foreign body and improve the likelihood of a diagnosis. Rigid bronchoscopy is required if aspiration of a foreign body is thought to be a possibility. A tracheobronchial foreign body should be treated urgently if there is clinical or radiological evidence of it in order to reduce morbidity and mortality. In order to avoid problems, all children with clinical or radiological signs of foreign body aspiration should have a rigid bronchoscopy as soon as possible. This treatment is the gold standard for identification and the removal of tracheobronchial foreign bodies.

## 7. Recommendations

- We recommend the appropriate body start bronchoscopic examinations at other area hospitals.
- We recommend all surgeons and residents try to make their documentation better.
- The best preventive measure for reducing the prevalence of this issue is education. It can be avoided by raising public awareness through the media of its severe repercussions and by educating parents to keep small things out of children's reach.
- We advise the responsible authority to try to bring the standard bronchoscope because our bronchoscope only has one port.

## Data availability statement

Data included in article/supp. material/referenced in article.

## CRedit authorship contribution statement

**Yohannis Derbew Molla:** Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Desyibelew Chanie Mekonnen:** Data curation, Writing – original draft. **Andinet Desalegn Beza:** Conceptualization, Formal analysis, Validation. **Hirut Tesfahun Alemu:** Formal analysis, Writing – review & editing. **Almaz Enku Selamawi:** Conceptualization, Data curation, Writing – original draft.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Abbreviations

FBA	Foreign body aspiration
RB	Rigid bronchoscopy
UoGCSH	University of Gondar Comprehensive Specialized Hospital

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