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# Foreign body aspirations in childhood: A retrospective review

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ABSTRACT

*Objective:* The aim of this study was to examine the childhood-age foreign body aspiration (FBA) retrospectively by focusing on symptoms, types, home interventions, hospitalization and complications.
*Method:* All patients between 0–18 years admitted to pediatric surgical clinic and diagnosed with FBA were examined retrospectively from January 2021 to January 2022.
*Results:* The study group consisted of 163 patients and their mean age was 17.8±12.7 months (1 months to 6 years). FBA events included aspiration of food (78%), coins (10%), batteries (3.7%), parts of toys (4%), buttons (2.4%) and other (2%). First aid treatment to children was performed at home by mothers (61%). Types of first aid treatment performed by mothers included tapping the back (31%); cleaning inside the mouth (24%); trying to remove the foreign body with fingers (12%), pushing the foreign body forward (5.9%) and forcing the child to vomit (9.5%) respectively.
*Conclusions:* FBA is a potential life-threatening health problem during childhood. When the age of majority of patients being under one year old and prevalence of food in FBA types are taken into consideration, safe-feeding practices of mothers, feeding position and training about the safe-environment are the basic steps of prevention strategies.
*Practice implications:* One of the most useful ways of preventing FBA cases is to provide planned and continuing education to parents, care givers and all the individuals responsible for the care of the child in order to increase their knowledge and practice levels.



## Introduction

Foreign body aspiration (FBA) is a health problem that is caused by a foreign object's entering the airway lead to obstruction and hypoxia and having indications according to degree of obstruction (Ding et al., 2020; Liu et al., 2020). FBA occurs when foreign objects enter the airway and causes a partial and complete obstruction. Clinical characteristics changes according to the location of the foreign body. Symptoms may be coughing on acute onset, difficulty in breathing, choking and 10–20% of the patients might be asymptomatic as well (Bajaj et al., 2021). Morbidity and mortality rates increase in younger children due to narrow airway and immature protective mechanisms. Its incidence is estimated at 29.9/100.000 population and the mortality rate from FBA ranges from 0.7 to 1.8%. (Abu-Hasheesh & El Bahnasawy, 2011; Lowe et al., 2015; Mansour & Elias, 2015). Approximately 80% of FBA cases are observed in children younger than three years old and the highest incidence is reported between one-two years old children (Pekcan et al., 2015; Vidhya et al., 2021). FBA is in the fourth place among accidental death rates for under three years old children and it is the third for under one years (Lowe et al., 2015). Children under one year tend to discover the environment with their mouths and they have necessary fine motor skills to place an object into their mouths. However they do not have molar teeth to masticate the objects sufficiently as well as immature swallowing mechanisms (Ozakar Akca, 2016; Xu et al., 2022). Due to relatively small diameter of the tracheobronchial tree, foreign body causes stridor and acute respiratory problems by entering proximal airway of children. The severity of FBA related symptoms depend on the place and the severity of obstruction (Ding et al., 2020; Sultan & Bastiaan van As, 2016).

Timely actions might prevent severe and life-threatening complications and reduce the level of mortality as well. Early diagnosis is the most important timely action to prevent complications and mortality. The diagnosis is made at early period and when the foreign body is extracted the risk of complication is reduced. Late diagnosis or not being treated appropriately despite the early diagnosis may lead to various complications such as severe and recurring pneumonia, lung abscess and bronchiectasis (Liu et al., 2020; Xu et al., 2022).

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The diagnosis of a foreign body base on the history of the child's illness, symptoms, and the combination of radiological results (Bajaj et al., 2021; McKinney et al., 2017). In the history of child's illness FBA may be diagnosed by family members noticing the child's swallowing or eating a small object then coughing, difficulty in breathing and respiratory system deficiency like cyanosis. The golden standard in the diagnosis and treatment of FBA is bronchoscopy which is an invasive procedure (Lowe et al., 2015). Bronchoscopy is applied both to find and to remove the foreign body. It is 95% useful in the removal of foreign body with less than 1% of complication rate (Liu et al., 2020; Sultan & Bastiaan van As, 2016). FBA is life-threatening yet preventable condition in pediatric age-groups. Increasing parents' knowledge and practice is essential for preventing FBA and for proper management (Abu-Hasheesh & El Bahnasawy, 2011; Higuchi et al., 2013; Sarabi & Nosratabadi, 2022). The studies on FBA is rather limited in pediatric nursing. We need more study results in order to put forth efficient nursing interventions even though educations provided for parents were demonstrated as highly effective. The results of this study will contribute to increasing the awareness of pediatric nurses by showing the current situation about FBA. The purpose of the present study was to examine the childhood-age FBA retrospectively by focusing on symptoms, FBA types, home interventions, treatment, hospitalization and complications.

## Methods

### *Design*

This study has a retrospective design.

### *Sample and setting*

This study was conducted between January 2020 and January 2021 in Istanbul, Turkey. We reviewed the medical records of all children aged 0-18 years diagnosed with FBA in the pediatric surgery clinic of a public hospital. Since whole patients admitted to the pediatric surgery clinic during the one year period were included in the study, no sampling strategy was used. The inclusion criterion for the study was the cases admitted to hospital diagnosed as FBA. The children diagnosed as FBA however being negative following the bronchoscopy were excluded in the study. There were not any patients with incomplete medical records in the sample meeting the inclusion criteria. Thus, no loss occurred in sample due to data-shortage.

### *Data collection*

The following variables were abstracted for each patient during the data collection process; age, gender, the duration between the aspiration and diagnosis, FBA type, home interventions, method of treatment, hospitalization process and complications. A data collection form including all these variables was created by the researchers and the data were recorded in this form. Data was collected by two researchers who were pediatric nurses.

### *Ethical considerations*

The present study was approved by the Institution's Clinical Research Ethics Committee (approval n.2019-K060) and conducted following the ethical standards of the World Medical Association Helsinki Declaration. The official permission was obtained in order to access the database of the hospital. Since it was a retrospective study, consent was not required for the analysis of data from medical records. In every stages of the study, anonymity and privacy were guaranteed. The data collected in the study did not include any details related with the identities of the participants.

### *Data analysis*

The data were analyzed using statistical package of SPSS version 25.0. Universe of the study was defined through retrospective data set and sample-size calculation was not realized. Descriptive statistics of the data were generated. All data were expressed as frequency (percentage) or mean ± SD. Comparisons between categorical variable groups were performed using the $\chi 2$ test. A $p$ value $< .05$ was considered statistically significant.

## Results

In this study carried out between 1st of January 2020 and January 2021, 194 children with suspected FBA were admitted and 163 of them were diagnosed. The mean age of the children was 17.8± 12.7 month and ranging from 1 to 72 months. Sixty-seven percent of them were **males** and 33% of them **females** and the difference was statistically significant ($p = .034$). Fifty nine point eight of the children were under one years old; 24.2% of them between 1 and 3 years and 16% of them over 3 years (Table 1). FBA was noticed coincidentally in 3.6% of the children yet 96.4% of them noticed following the symptoms occurring due to foreign body. All the admissions of children were emergency. When admitted to hospital vital signs of children; pulse mean 109 ± 11.3/min; body temperature mean 36.1 ± 1.03 °C; oxygen saturation mean 93 ± 2.7%.

Among the most prevalent FBA symptoms were cough and respiratory distress 51.4% ($n = 84$); vomiting 36% ($n = 58$); cyanosis in addition to respiratory distress 12.6% ($n = 21$). Eighty point 6 % of children aspirated food. The most prevalent aspirated food was nut (15.4%) followed by seed (9.3%); fruits (7%) respectively. Except for food, coins

**Table 1**
Participant clinical characteristics.

| | Mean ± SD | Min-Max |
|---|---|---|
| Mean age (month) | 17.8 ± 12.7 | Jan-72 |
| Hospitalization time | 1.5 ± 1.3 | Jan-15 |
| | n | % |
| Gender | | |
| Female | 54 | 33 |
| Male | 109 | 67 |
| Age (year) | | |
| 0–1 | 116 | 59.8 |
| 1–3 | 38 | 24.2 |
| 4–5 | 8 | 5.7 |
| 6 | 1 | 1 |
| Symptoms[a] | | |
| Cough and respiratory distress | 84 | 51.4 |
| Cyanosis | 21 | 12.6 |
| Vomiting | 58 | 36 |
| Fever | 20 | 12.2 |
| Stridor | 3 | 1.8 |
| Home-based intervention | | |
| Yes | 87 | 53.6 |
| No | 76 | 47.4 |
| Home-based interventions | | |
| Backslapping | 27 | 31 |
| In-mouth cleaning | 21 | 24 |
| Pressing the child's stomach | 15 | 16.7 |
| Trying to extract the foreign body using fingers | 11 | 12 |
| Force to vomit | 8 | 9.5 |
| Pushing the foreign body forward | 5 | 5.9 |
| The duration between FBA and hospitalization | | |
| 30 min | 60 | 36.9 |
| 1–3 h | 36 | 22.1 |
| 4–8 h | 32 | 19.5 |
| 9-12 h | 16 | 9.6 |
| 12–24 h | 13 | 7.8 |
| 1–10 days | 6 | 4 |
| Treatment | | |
| Bronchoscopy | 163 | 100 |

[a] Presence of more than one symptom.

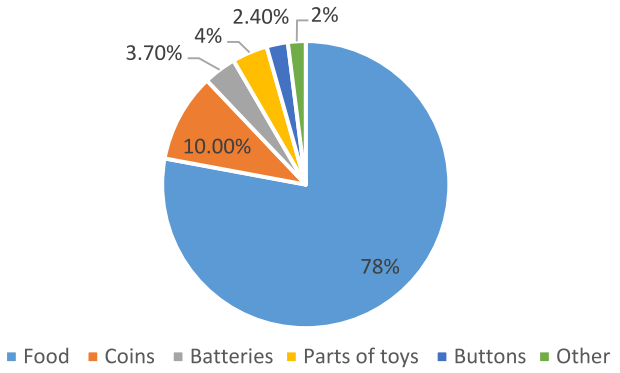


**Fig. 1.** The distribution of objects aspirated by children.

(10%), batteries (3.7%), buttons (3.5%) and part of toys (4%) were aspirated objects, and all children who aspirated these objects were between 12 and 24 months of age. Even though there was not any significant difference regarding the type of food aspired between genders, the number of **males** aspirating coins and batteries were significantly higher than **females** ($p = .028$). The distribution of aspired bodies by children were demonstrated in Fig. 1. The shortest time to reach the hospital was 5 min, while the longest was 10 days. After aspiration, 36.9% of children reached the hospital within 30 min and 22.1% within 3 h (Table 1). Fifty three point six of the children were done first-aid at home whereas 47.4% of them were admitted directly to hospital without any interventions. The person doing the first-aid at home was mostly the mothers (61%), secondly the fathers (33%) and followed by others (neighbours, grandfather-grandmother, relatives). The most frequently applied interventions regarding home-based first-aid methods were backslapping (31%); cleaning inside the mouth (24%) and trying to extract the foreign body using fingers (12%). First aid interventions at home are shown in Table 1. As a diagnostic process in admission to hospital, all the cases were requested chest radiography, 30% of them were requested blood gas inspection in addition to chest radiography and 5.2% of them computed tomography. Bronchoscopy was performed in all patients and the foreign body was removed. None of the patients had complications after bronchoscopy. The duration form admission to discharge was mean 1.5 ± 1.3 days (range 1–15 days). Majority of the patients discharged from the hospital at the second day (55.2%) while 28.9% of them were hospitalized three days, 5.7% of them four days, 3.1% of them 7+ days. There was not any re-hospitalized patients due to complications and not any mortalities were identified.

## Discussion

FBA is a common emergency reason related with respiration for younger children and a potential life-threatening problem (McKinney et al., 2017; Na'ara et al., 2020). At present study we aimed at examining the characteristics of children admitted to pediatric surgery clinic due to FBA within a year. The majority of the study group (59.8%) were under one year old and 84% of the whole sample under 3 years old. Studies on this issue reported that FBA occurred in children younger than 3 years and the data related with under one year old incidence were fairly limited. For instance; in the study conducted by Liu et al. (2020), it was reported that 71.4% of children admitted to emergency service of the hospital due to FBA were 0–3 years whereas it was reported in the study by Higuchi et al. (2013) that 78.6% of the children were younger than 3 years. Na'ara et al. (2020) showed in their study that 15% of FBA cases were infants and 85% were older than one year. Infants, from six months on, begins to discover the new objects around them as a part of their sensory-motor, emotional and cognitive development thus demonstrating the incidence of FBA cases occuring at this age group which is known to be lethal may offer an insight into prospective interventions (Moslehi, 2023). Majority of our patients were males with a rate of 1/2 compared with the females. Such a result was compatible with the literature since the males are more interested in more energetic, impulsive and adventurous games than females (Sultan & Bastiaan van As, 2016).

According to results of the study, food was the most commonly aspirated object. Among these, nuts, peanuts, and seeds were the most common. In literature, the most prevalent aspired food were reported as vegetables and dried fruit (McKinney et al., 2017; Pekcan et al., 2015; Saki et al., 2009). Peanuts was identified as the most common cause of FBA in various studies and sunflower seeds were the identifies food on the issue. In their study conducted with a sample group of 524 children diagnosed as FBA, Mahafza and Khader (2007) demonstrated peanut as the most common aspired food followed by other objects as seed (35.4%), specifically watermelon seeds, nuts (26.8%) and vegetables (25.3%). High prevalence aspiration of seed might be associated with insufficient chewing owing to immature molar teeth in children. Variety of food as a reason of FBA may emerge from cultural and regional diversity as well as different eating habits. For example; sunflower seeds are the most common aspirated food in Middle East countries (D'Addio et al., 2022). Apart from food, coins, batteries, buttons and toys (4%) were as the most prevalent aspired objects in our study. All of the battery aspirations were the batteries of toys. Furthermore, food was the most common aspirated objects for under 12 months old children whereas it was toys, batteries and buttons for the children over 12 months old. It is related with increasing tempo of child's movement and inserting everything to mouth in order to discover the outer world (Melek et al., 2011). Battery aspiration is a life-threatening condition due to the their potential to cause great local damage and severe mucosal injury with their electrochemical content (Melek et al., 2011; Thabet et al., 2013; Xu et al., 2022). It is rather crucial to inform parents, caregivers and the society about the potential risks of battery aspirations. Our study together with similar ones may contribute the reducing of battery aspiration cases by leading to certain changes in production processes such as hiding of batteries or fixing them behind the toys (Xu et al., 2022). Furthermore; parents' informing about paying attention to warning signs on toys packages and obeying the rules of their use is a critical point to reduce the foreign body aspiration cases.

Our results put forth that respiratory distress and coughing were the most prevalent FBA symptoms as well as cyanosis. Clinical symptoms and physical indicators are usually associated with size, type, place of the FBA and the age of the patient. In other studies on the other hand such non-specific symptoms as coughing, wheezing, dyspnea and vomiting are frequently reported (Xu et al., 2022). Even though fever and hemoptysis were reported in some other studies, they were not detected in our study. According to results of the study, backslapping, intraoral cleaning and pushing the foreign body forward are the most frequent intervention methods applied by the mothers. 3/2 of the FBA-related mortalities occur at home setting before admitting to the emergency so the first-aid is generally performed by mothers. Thus, timely and appropriate first-aid might prevent severe and lethal complications reducing the mortality rates in children (Lluna et al., 2017; Ozakar Akca, 2016). According to results of the current study, the frequently applied intervention methods of mothers were backslapping, in-mouth cleaning, removing the objects with fingers. Such interventions are described as a natural reflex of caregivers or parents to perform in-mouth cleaning when encountered with coughing, respiratory distress. This kind of an intervention defined as 'Blind Finger Sweep Maneuver' in literature is emphasised to trigger sticking of foreign body as well as obstrucying the airway completely (Abder-Rahman, 2009; Tonson la Tour et al., 2017). Even if the foreign body appears at the back of throat, it is not appropriate to remove it by fingers due to the possibility of pushing it forward. Removing of those foreign bodies require Heimlich maneuver and basic life-support. In certain studies on this issue especially mothers' lack of sufficient knowledge about the first-aid was demonstrated as one of the reasons of FBA mortality

(Abu-Hasheesh & El Bahnasawy, 2011; Behboudi et al., 2022; Higuchi et al., 2013; Sarabi & Nosratabadi, 2022).

The limited study results revealed that increasing parental knowledge and skills on possible risks, symptoms and management of FBA may save the lives of children (Karatzanis et al., 2007; Thabet et al., 2013). For example; in the study by Vidhya et al. (2021) it was reported that video-based training about first-aid interventions to FBA cases for mothers of under five years children were rather efficient in developing the knowledge of mothers. In another study positive effect of mobile-based education in knowledge and decision-making processes in the protection of FBA was demonstrated (Behboudi et al., 2022). Consequently, having fairly limited data about FBA in the field of pediatric nursing, this study together with similar ones might a guide in the developing of new intervention methods. Revealing the characteristics of the child, FBA types and interventions at home in FBA accidents will increase the awareness of pediatric nurses about providing education and counseling to parents about safe care practices.

The strengths of our study are that it reveals the distribution of ages, FBA types, and parent intervention methods in FBA cases in the study population consisting of children diagnosed with FBA. Furthermore, this hospital database-based study showed that children younger than one year were more likely to aspirate food than older children. Our study adds valuable outcome data to the sparsely available evidence for FBA cases.

### *Practice implications*

The results of present study revealed that children younger than 12 months are the most risky group with respect to FBA and mothers or primary care givers of this age group should be given priority in FBA prevention interventions aiming to develop knowledge, practice on this issue. The role of a pediatric nurse is closely related with prevention FBA cases. It is the first step to raise awareness in society about the risks of giving children certain food, toys and objects to younger children in the prevention of FBA cases. Media can be an important tool to increase social awareness. In addition, providing parents individual training is reported as an efficient method in prevention of FBA. Preventive measurements should aim not only parents but also caregivers, teachers and the whole society as well. Pediatric nurses should provide training and encouragement on first-aid to the families and the children. Baby-care education provided at pregnancy period may include such awareness-raising facilities about FBA.

### *Limitations*

The present study has certain limitations. Firstly, single centered conducting of the study limits the generalizability of the results. Secondly, although several important socio-demographic factors have been identified, it is possible that unmeasured variables (for example, socioeconomic characteristics of the family) cannot be ignored because we were unable to obtain further details in this retrospective design. Thirdly, since our data collection method based on retrospective records, case determination bias limitation occured at present study.

## Conclusion

In conclusion, this study examining FBA cases admitted to pediatric surgery clinic, the most prevalent aspirated objects were food following batteries, toy parts and buttons. The most frequent interventions implemented at post accident stage at home were backslapping, intraoral cleaning, trying to extracting the foreign body with finger and pushing the foreign body forward. Enhancing the knowledge and skills of individuals responsible for the care of the child about the prevention and management of FBA is among the responsibilities of pediatric nurses. Parents and caregivers should be provided education via structured programmes about safe-care practices. Those education programmes should involve safe-eating practices, eating position, toy safety and safe environment. Management of FBA is an essential issue in the prevention of mortality thus first-aid practices should include not only parents but also all the individuals responsible for the care of the child.

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## CRediT authorship contribution statement

**Ayfer Ekim:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Aslıhan Altun:** Conceptualization, Investigation, Data curation, Writing – original draft.

## Declaration of Competing Interest

None.

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