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Foreign body aspiration in children: A study of children who lived or died following aspiration

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ABSTRACT

Foreign body aspiration (FBA) is a preventable cause of mortality and morbidity in children. We conducted a chart review of children who presented to a university hospital due to FBA in the period 1999–2014. Children were either managed with bronchoscopy for removal of the foreign body or died due to FBA. A total of 103 children were seen due to FBA including 27 deaths. The majority of children were boys and were less than 3 years old. Most aspirated foreign bodies were food-related, mainly peanuts. The majority of children presented with acute choking incidents, a smaller number presented with recurrent chest infections, and few children's choking incidents were unwitnessed. X-ray had a high rate of false negatives and bronchoscopy was the gold standard technique for assessment and management. Aspiration of foreign bodies is a preventable, life-threatening condition that calls for increased parent education and awareness.

1. 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 [1]. Aspiration of foreign bodies is an important and preventable cause of mortality and morbidity in children, especially those less than 3 years of age [2–4]. This problem has not ceased to be a cause of major complications, as severe as death, in low and high-income countries [3,5,6].

The high incidence of aspiration in children less than 3 years old is attributed to the absence of molar teeth which reduces their ability to properly chew food items such as peanuts or melon seeds [4,7–9]. Aspiration can also occur on non-food items, such as small plastic or metal objects [8]. The majority of aspiration cases are on food items [10,11].

The majority of children with the condition present with coughing, suffocation, wheezing, and reduced air flow [8,12–15]. Less common presenting symptoms include cyanosis or syncope [3,10]. Asymptomatic presentations have been reported as well [5,8,10]. In many cases, witnessing the choking incident is the determinant factor to initiate the management of FBA [5,14]. But, in many occasions, the choking episode may be unattended leading to delayed diagnosis especially if no clear clinical manifestations were present [3,16]. Respiratory complications following FBA include emphysema and pneumonia [12,17]. If the foreign body settled in the lower respiratory tract, complications may include emphysema and collapse of the bronchi [8].

Even though X-ray can aid in the diagnosis of FBA, aspiration of radiolucent items is often missed on the x-ray leading to delayed diagnosis [5,8]. The gold standard management of identified FBA involves rigid bronchoscopy for the localization and removal of the aspirated foreign body [5,10]. Recent studies discussed the use of flexible bronchoscopy for removal of foreign bodies [15,18], the benefits of this new technique are yet to be determined.

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Nonetheless, proper management can be delayed in unconfirmed cases [13]. Delayed diagnosis is associated with increased complications in cases without acute presentation [19].

The aim of this study is to provide results on foreign body aspiration in a group of children who were managed and in a group that died due to FBA. We describe the age, gender, location and type of foreign body, and duration since aspiration in the two groups. Comparisons between the two groups on age and gender differences are also reported. While several reports are available on FBA in children, our report is unique in examining this problem in children who were managed and those who died due to aspiration.

2. Methods

This study was a retrospective chart review for all children admitted to Jordan University Hospital, who were diagnosed with foreign body aspiration between 1999 and 2014. The charts were divided into children managed with bronchoscopy due to FBA and deaths due to FBA. The study was approved by the Institutional Review Board at the hospital.

Upon admission to the emergency room, all children with history or suspicion of FBA or recurrent chest infection underwent vital signs check and chest x-ray. Following x-ray, children underwent rigid bronchoscopy to locate and remove foreign bodies. All children with suspected FBA underwent bronchoscopy regardless of the x-ray findings. Rigid bronchoscopy was performed under general anesthesia and controlled breathing for all patients. Children with recurrent chest infection underwent the same procedure as children with FBA suspicion to rule out a foreign body as the cause of infection.

Among the deaths, many children arrived dead to the hospital or died shortly after arrival. In this group either history was strongly suggestive of aspiration as the cause of death or an aspirated foreign body blocking a major airway was found during autopsy.

3. Statistical analysis

Descriptive values were computed as frequencies (numbers and percentages) and mean (SD) or median (IQR). The difference between children managed due to FBA and deaths was compared using independent samples *t*-test for age and chi-square test for gender. Level of significance was set at $\alpha < 0.05$. All computations were done using SPSS version 18.0 (SPSS, IL, USA).

4. Results

4.1. Children managed due to FBA

Seventy six children between the ages of 4 months−17 years were managed in Jordan University Hospital due to choking incidents. The mean age of this group was 3 years and 9 months and the median (IQR) was 2 (1;5−5) years. Among those children, 71.1% (54/76) were less than 3 years old and 59.2% were boys. Demographics of children managed due to FBA are presented in Table 1.

While the majority (88.2% = 67/76) of children presented with acute choking incidents, there were 7.9% (6/76) who presented with recurrent chest infection. Three of those 6 children had been having infections for more than 3 months before they were diagnosed with FBA. Among those children, 69.7% (53/76) were managed within hours − 3 days of choking, and the remaining children took a maximum of one month till diagnosis and management.

When the nature of the aspirated foreign body was examined, peanut constituted the majority of aspirated food items (in 32 children out of 52 who aspirated on food items). Other food items included beans, sunflower seeds, melon seeds, etc. Non-food items included pins, coins, and plastic pieces.

Although x-ray has been done in all children in this sample, the findings were normal in 66% of the children. Bronchoscopy was used for the diagnosis and removal of the foreign body in those children.

4.2. Deaths due to foreign body aspiration

Twenty seven children died between June, 1999 and August, 2014 due to foreign body aspiration. Ages of 26 of the deaths ranged between 7 months−7 years and only one death was for an 11 years-old boy. The mean (SD) age of deaths -excluding the outlier-was 30 (22) months. A large number of deaths (40.7% = 11/27) occurred in the 1−3 years old age group, and the majority of deaths were among boys (59.3% = 16/27).

Among families that were asked about their children's exposure to foreign bodies, the cause of aspiration was known by the child's family in only half of the cases (12/24). Ten children died immediately following the aspiration incident and another 7 were dead by the time they arrived to our hospital. Seven of the remaining 10 children died within 24 h of admission to the hospital.

During autopsy, foreign bodies lodged in the larynx or trachea were the cause of death in 21 children and in the right main bronchus in only 5 children. Fifteen children had aspirated food items such as rice, pomegranate, peanut, chickpea, or kidney beans. The remaining twelve children had aspirated non-food materials, half of which were balloons.

There were no statistically significant differences in age or gender between children who lived or those who died due to FBA.

5. Discussion

Children, particularly boys, less than 3 years of age represent the population at high risk of FBA [2,3,8,10,14]. The increased risk is in part due to the lack of molar teeth and the exploration by mouth [4,7,11]. Our review of charts at a university hospital in Jordan confirmed these findings; among a group of 76 children managed due to FBA, 59.2% were boys and 71.1% were less than 3 years old, among 27 deaths due to FBA, 59.3% were boys and 74.1% deaths were among children less than 3 years old.

The aspiration incident was not attended by half of the families of the children who died in our sample. It was only after autopsy that a foreign body was found blocking the airways. Often, management of aspiration is initiated by witnessing the choking incident [5]. Among children with aspiration, 30% took more than 3 days to be managed. Delayed diagnosis has been reported previously and has been associated with increased complications and mortality [4,8,13]. Saki et al. reported aspiration duration up to 6 months [8], in our sample few chronic cases had aspirated a foreign body for as long as a year before diagnosis with FBA. Prior to correct diagnosis, those children were managed for recurrent chest infections.

When we examined the items children choked on, we could observe similarity to items reported previously in developing and developed-countries. Children choked on food items, particularly peanuts [3,5,9,20]. It is worth noting that in our sample a considerable number of deaths were due to aspiration of balloons, an item that children commonly play with which can be easily inserted into the mouth leading to the blockage of a major airway due to its elastic nature.

X-ray remains a preferred diagnostic tool by physicians, the reason being that many children present without confirmed history or clinical presentation of FBA. However, the sensitivity of x-ray in identifying FBA is not optimal. Our results show 66% false negative

Table 1
Demographics and characteristics of children managed due to FBA.

		Percentage
Age (years)	Median (IQR)	2 (1;5–5) year
Gender (n)	Male/female	45/31
Presentation (n)	Acute history of chocking	67
	Recurrent chest infection	6
	Other presentations (cyanosis, stridor, and epistaxis)	3
Duration of symptoms (n)	Hours	23
	Days	33
	Weeks	12
	Months	6
	Years	2
Bronchoscopy findings (n)	Food item	52
	Non-food item	14
	Others	10

rate for x-ray. A finding that has been confirmed previously in the literature [5,10], this might be due to the fact that most aspirated foreign bodies were food items [14]. Although not widely used in the diagnosis of FBA, computed tomography might prove to be a more useful method when dealing with aspiration of food items [4].

The retrospective nature of this study is one of its limitations. While several studies, including ours, report the characteristics of children susceptible to FBA and the nature of items children often choke on, to our knowledge no previous studies have examined the factors related to families of children who present with aspiration. The role of parents of such young children must not be underestimated. Possible risk factors that identify “high-risk” families will definitely help target those families with advices and education to increase their awareness of the risks and complications of FBA.

6. Conclusion

Foreign body aspiration is a life-threatening condition. The majority of cases presenting with FBA are boys and children less than 3 years of age. Ample cases of FBA present without clear history or clinical manifestations leading to delayed management or even death.

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