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Frequency of signs and symptoms in children with foreign body aspiration: A retrospective study in Iran

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ABSTRACT

Foreign body aspiration is still one of the most important diagnostic and therapeutic items for physicians. The mortality rate and prevalence of diseases caused by foreign bodies are higher in children due to the relatively narrow airway and immature protective mechanisms. Considering the high prevalence of foreign body aspiration in children, as well as the possible complications, we decided to investigate the frequency distribution of signs and symptoms in children with foreign body aspiration. This retrospective cross-sectional study was performed on the files of 50 children with foreign body aspiration who referred to Khatam Al-Anbia Hospital in Zahedan, Iran from 2016 to 2018. The files were entered into the study by the census method, based on inclusion and exclusion criteria. Finally, demographic factors (age and sex), as well as the type of aspirated object, signs, and symptoms, were examined. The files of 50 children with a foreign body aspiration were reviewed. Among the patients, 27 (54%) were boys and 23 (46%) were girls. The highest frequency was between 1 and 2 years, with 36%. The most common symptom in these patients was cough and respiratory distress with a frequency of 72% and the most common clinical findings were unilateral wheezing with 50% and decreased unilateral respiratory sounds with 18%. Also, the most common types of foreign objects were nuts with a frequency of 44% and supari with 38%. Also, unilateral wheezing had a significant relationship with the type of aspirated foreign body ($P = 0.01$). Children between the ages of one and two years are more likely to have foreign body aspiration, and in children with symptoms of cough and respiratory distress, as well as clinical findings of unilateral wheezing and decreased unilateral respiratory sounds, foreign body aspiration should be suspected.



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INTRODUCTION

Foreign body aspiration for anatomical reasons as well as developmental reasons is still one of the most important causes of child mortality (Dodson and Cook, 2020). According to the National Safety Council, in 2016, the rate of fatal suffocation in American children under 5 in the general population was 0.43 per 100,000 people.

However, another study analyzing non-lethal asphyxiation data in children under 14 years of age showed a relatively higher rate of 20.4 per 100,000 (Cramer *et al.*, 2018). Asphyxiation is

commonly known as an aerodigestive foreign body that blocks the airways, which can eventually lead to ventilation and oxygenation problems (Salih *et al.*, 2016). Children are more at risk of aspiration due to the lack of molar teeth and as a result of improper chewing of food and performing various activities such as talking, laughing, and even turning around while eating (Cichero, 2018; Kazemi *et al.*, 2011). Commonly known foreign bodies in children include food, coins, and toys that can lead to hypoxic-ischemic brain damage or pulmonary hemorrhage (Alshehri *et al.*, 2019).

There are three stages of foreign body symptoms in the airways. In the first stage, in most cases of aspirated foreign bodies, there is a definite history of suffocation followed by a paroxysmal cough and possibly airway obstruction that occurs immediately following aspiration of the foreign body, which may eventually subside.

After that, an asymptomatic period occurs, which is responsible for the delay in diagnosis. In the third stage, as the stage of complications, wounds, blockages or infections may occur, which cause paying attention to the foreign object again. These complications include fever, cough, hemoptysis, pneumonia, and atelectasis (Foltran *et al.*, 2013; Behrman *et al.*, 2007).

Chest radiography is often used as the primary research tool for foreign body aspiration. Standard radiological evaluations include posteroanterior radiography, lateral chest X-ray, and soft tissue radiography of the neck. All of this should be done in patients who are suspected of foreign body aspiration. However, it should be noted that chest X-rays may appear normal in the first 24 hours and that most foreign bodies are radiolucent. Radiographic findings such as atelectasis, pulmonary infiltration, and mediastinum shift may indicate aspiration (Janahi *et al.*, 2017; Passali *et al.*, 2010). In addition, since no clinical signs or findings can definitively assess tracheobronchial foreign body aspiration, research should also be performed using bronchoscopy in suspected cases (Ganie *et al.*, 2014).

Therefore, any child with a previous history of suspected foreign body aspiration or clinical and radiographic evidence of a tracheobronchial foreign body is considered an emergency and should be treated promptly (Adjeso *et al.*, 2017). Therefore, considering the high prevalence of foreign body aspiration in children, as well as the possible complications and variability of signs and symptoms in previous studies, in this study we decided to evaluate the frequency distribution of signs and symptoms in children with foreign body aspiration.

METHODS

In this retrospective cross-sectional study, the files of children with a definite diagnosis of foreign body aspiration (by an ENT specialist) referred to Khatam Al-Anbia Hospital in Zahedan, Iran from 2016 to 2018 were studied. The present study was performed after the approval of the ethics committee with IR.ZAUMS.REC.1399.139 code and the research committee of Zahedan University of Medical Sciences. All information forms were completed by the researcher based on patients' hospital records. In this study, the inclusion criteria were considered children under 15 years of age as well as the completeness of the bronchoscopy file, and patients who did not meet the above conditions were excluded from the study. Finally, after reviewing the files by the census method, the files of 50 eligible children were reviewed. Then, demographic information, including the age and sex of the children as well as the type of aspirated object, signs, and symptoms, were evaluated. Also, all the information and secrets listed in the patients' files were kept confidential and the study was performed based on the general guideline of ethics in medical research with human subjects in the Islamic Republic of Iran.

Data analysis

After the collection, the data were analyzed using SPSS software version 25. In order to describe the data, descriptive statistics including statistical tables, graphs, and frequencies in percentages were used, and the Chi-square test was implemented to compare the frequencies in groups. The significance level was considered less than 0.05.

RESULTS

After examining 50 children with a definite diagnosis of foreign body aspiration, it was found that the mean age of patients was 2.56. 1.80 years and most children with this complication were 1 to 2 years old (18 people, 36%) (Table 1). Also, according to Table 1, most of the children in this study were boys (27 people, 54%).

Also, based on Table 2, it was found that there was no significant relationship between the frequency distribution of gender and age group ($P = 0.66$)

Study of the type of aspirated body also showed that nuts (22 patients, 44%) was the most aspirated foreign body in children (Table 3). Also, according to Table 3, unilateral pulmonary wheezing (25 patients, 50%) was the most common sign, and cough and respiratory disorder (36 patients, 72%) was the most common symptom in children with foreign body aspiration.

Table 1: Frequency distribution of demographic factors of children with a definitive diagnosis of foreign body aspiration

	Variable	N	%
Age	< 1	6	12
	1-2	18	36
	2-3	11	22
	3-4	5	10
	4-5	3	6
	5-6	4	8
	6-7	1	4
	7-15	2	2
Sex	Male	27	54
	Female	23	46

Table 2: Determining the relationship between the frequency distribution of gender and age group

Age group Sex (Year)	Male (N(%))	Female (N(%))	P-value
<1	4(14.8%)	2(8.7%)	0.66
1-2	12(44.4%)	6(26.1%)	
2-3	6(22.2%)	5(21.7%)	
3-4	2(7.4%)	3(13%)	
4-5	1(3.7%)	2(8.7%)	
5-6	1(3.7%)	3(13%)	
6-7	-	1(4.3%)	
7-15	1(3.7%)	1(4.3%)	
Total	27(100%)	23(100%)	

Table 3: Frequency distribution of foreign body type and occurrence of signs and symptoms in children with foreign body aspiration

	Variable	N	%
Foreign body	Nuts	22	44
	Supari	19	38
	Toys	4	8
	Beans	3	6
	Food	2	4
Signs	Unilateral wheezing	25	50
	Decreased unilateral respiratory sounds	9	18
	Bilateral wheezing	6	12
	Stridor	4	8
Symptoms	Cough	36	72
	Respiratory distress	36	72
	Wheeze	16	32
	Fever	12	24
	Crying and restlessness	1	2

Table 4: Comparison of the frequency of signs and symptoms in children with foreign body aspiration

Foreign body		Supari	Nuts	Beans N(%)	Food	Toys	P-value
Clinical symptoms							
Cough	Had	13(68.4)	15(68.2)	3(100)	2(100)	3(75)	0.69
	Had not	6(31.6)	7(31.8)	-	-	1(25)	
Respiratory distress	Had	13(68.4)	16(72.7)	2(66.7)	1(50)	4(100)	0.69
	Had not	6(31.6)	6(27.3)	1(33.3)	1(50)	-	
Fever	Had	7(36.8)	2(9.1)	1(33.3)	-	2(50)	0.15
	Had not	12(63.2)	20(90.9)	2(66.7)	2(100)	2(50)	
Wheeze	Had	7(36.8)	8(36.4)	-	-	1(25)	0.58
	Had not	12(63.2)	14(63.6)	3(100)	2(100)	3(75)	
Crying and restlessness	Had	-	1(4.5)	-	-	-	0.86
	Had not	19(100)	21(95.5)	3(100)	2(100)	4(100)	
Clinical signs							
Unilateral wheezing	Had	4(21.1)	11(50)	3(100)	-	-	0.01
	Had not	15(78.9)	11(50)	-	2(100)	4(100)	
Decreased unilateral respiratory sounds	Had	4(21.1)	2(9.1)	-	1(50)	2(50)	0.21
	Had not	15(78.9)	20(90.9)	3(100)	1(50)	2(50)	
Bilateral wheezing	Had	1(5.3)	4(18.2)	-	-	1(25)	0.56
	Had not	18(94.7)	18(81.8)	3(100)	2(100)	3(75)	
Stridor	Had	1(5.3)	3(13.6)	-	-	-	0.74
	Had not	18(94.7)	19(86.4)	3(100)	2(100)	4(100)	

In the present study, the most common clinical symptoms based on the aspirated foreign body type were respiratory disorders with 16 cases (72.7%) and cough with 15 cases (68.2%), which were observed in children with aspirated nuts; But none of these differences was significant ($P > 0.05$). The most common signs based on the type of aspirated foreign body were unilateral wheezing with 11 cases (50%) and decreased unilateral lung sound with 4 cases (21.1%) in children with aspirated nuts, respectively (Table 4). According to our results, unilateral Wheezing had a significant relationship with the type of aspirated foreign body ($P = 0.01$), but no significant difference was observed in other cases ($P > 0.05$).

DISCUSSION

Aspiration of foreign bodies in the respiratory tract is one of the causes of respiratory problems in children, which leads to an increased risk of death and is a common cause of medical emergencies (Rose and Dubensky, 2019). The maximum risk of aspiration of foreign bodies in the respiratory tract of children occurs in the first 3 years of life and often in the age

range of 1 to 3 years (Kalyanappagol *et al.*, 2007; Aslan *et al.*, 2019). Also, in the present study, most of the children had foreign body aspirations in the age range of 1-2 years. The tendency of children at this age to place objects in their mouths, along with the immature neural mechanisms that coordinate inhaling and exhaling, as well as the habit of playing and laughing while eating, predispose children to foreign body aspiration (Idris *et al.*, 2018). In a similar study to ours, Rothmann and Boeckman observed 174 cases (77%) of foreign body aspiration in children under 3 years of age with a maximum incidence in children 1 to 2 years of age (93 cases) out of 225 patients (Rothmann and Boeckman, 1980). Puja *et al.* also reported a maximum incidence of this complication in children aged 1-2 years, with a ratio of 35.7% out of 95 patients (Puja *et al.*, 2017).

Also, in our study, most children with foreign body aspiration were male. Haddadi *et al.* also reported a male-to-female ratio of 73% to 27% of a total of 103 patients, citing male predominance and the more adventurous nature of men (Haddadi *et al.*, 2015). In addition, according to the results of the present study, the most common types of foreign

bodies were nuts with a frequency of 44% and supari with 38%. In the study by Haddadi et al., similar to our study, most (74.3%) of the inhaled foreign objects were organic matter such as nuts or sunflower seeds (Haddadi et al., 2015). In a study by Farzizadeh et al., Sunflower seeds were the most common aspirated foreign body (Farzizadeh et al., 2013). In general, it has been shown that the type of aspirated foreign body depends on the nature of the environment in which the child is located. Vegetative foreign body predominates in rural areas, while pins and coins are more common in urban populations. Vegetative foreign objects include seeds and nuts of fruits and vegetables, and inorganic materials include toys, pen caps, stones, marbles, balloons, etc. (Passali et al., 2015; Naragund et al., 2014; Ahmed and Shuiabu, 2014).

In the present study, the most common symptom in these patients was cough and respiratory distress with a frequency of 72% and the most common clinical findings were unilateral wheezing with 50% and decreased unilateral respiratory sounds with 18%. On the other hand, according to our results, unilateral wheezing had a significant relationship with the type of aspirated foreign body. In the study by Haddadi et al., non-productive cough (48.6%), wheezing (44.3%) and respiratory disorders (18.6%) were the most common complaints among patients (Haddadi et al., 2015). Also, Naragund et al. stated in their study that the most common symptoms of foreign body aspiration in 29 children were cough and wheezing in 20 cases (90.9%) followed by breathlessness in 16 cases (72.7%). In addition, in their study, right lung wheeze was the most common clinical finding, which was observed in 12 cases (54.5%), due to vegetative foreign body aspiration (77.3%) (Naragund et al., 2014).

Other studies have been conducted in line with the present study. In 2020, Reid et al. conducted a study in Australia with the aim of examining foreign objects in children's airways, in ten years. This study was performed on 127 patients who underwent micro laryngoscopy and bronchoscopy. Based on their results, a foreign body was found in 82% of patients. 82.7% of children had a cough, 81.1% had episodes of suffocation and 76.4% had respiratory failure.

61.45% of patients had decreased respiratory sound, 52.8% had wheezing, 29.9% had increased respiratory work and 11% had stridor. 96% of foreign objects were organic and 4% were inorganic. 49% of organic objects were nuts, 26% were fruits and vegetables. Among inorganic objects, plastic objects had the highest frequency (Reid et al., 2020).

Also, 75% of the foreign objects were organic, such as nuts, and 25% were inorganic, such as plastic parts. Finally, they stated that bronchoscopy is the best diagnostic and therapeutic method in all suspected cases of foreign body aspiration, and also in children, rigid bronchoscopy is the method of choice (Ding et al., 2020).

In general, it was demonstrated that, since the resistance to flow is inversely related to the radius of the airway raised to the fourth power, a small foreign object in the pediatric airway could induce significant airflow obstruction and severe consequences on respiratory function (Bhananker et al., 2014).

Tooth development also contributes to the risk of foreign body aspiration, as there are no molar teeth before the age of 2. Therefore children in this age group are able to eat pieces of food with their incisors but are not able to effectively chop food into the smaller piece (Mahmoud et al., 2012).

In addition, young children tend to eat while playing and show high activity and distraction when eating, putting them at greater risk. Due to the relative anatomical stenosis of the tracheobronchial in children, the proximal airways are usually the site of obstruction (Cramer et al., 2018; Schweiger et al., 2016). In fact, 96% of aspirated foreign objects are found in this area during studies (Haddadi et al., 2015; Sultan and van As, 2016). This is due to the symmetrical tracheal take-off angle, which is observed between the two bronchi in many children before the prominent aortic indent is formed in the trachea and left main bronchus. Regardless of age, if there is a significant aortic indentation on the trachea in the radiographic examination, the right bronchial angle is less pronounced than the left, and aspiration in the right lung is more likely (Cramer et al., 2018; Kumar et al., 2010; Xu et al., 2018).

Finally, such conditions can be prevented by properly educating parents about the size of food and proper supervision by child caregivers when children are playing with small objects.

CONCLUSION

According to the present study, children between the ages of one and two years are more likely to have foreign body aspiration. The most common symptoms in these patients were cough and respiratory distress and the most common clinical findings were unilateral wheezing and decreased unilateral respiratory sounds. Also, the most common types of aspirated foreign bodies were nuts and supari. On the other hand, unilateral Wheezing had a significant relationship with the type of aspirated foreign body.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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