

Foreign body aspirations in children- it is a single center experience

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Abstract

Aim: Foreign body aspiration causes serious mortality in children and is an important emergency condition requiring early diagnosis and bronchoscopy in the childhood period. In our research, we evaluated data from cases treated with the diagnosis of foreign body aspiration within 9 years in our clinic in terms of the complications during and after the procedures. This study aimed to determine the demographic and clinical characteristics of patients admitted for foreign body aspiration, to evaluate bronchoscopy findings, and to compare early and late-diagnosed patients.

Material and Methods: The files of cases that underwent bronchoscopy for a suspected foreign body aspiration in our hospital from January 2010 to September 2019 were investigated retrospectively. A total of 54 children were evaluated. All the bronchoscopies were performed with general anesthesia. The patients were evaluated in terms of clinical and examination findings, radiological findings, and complications that developed during and after anesthesia.

Results: Of all the patients, 63% were boys. The most common findings on admission were cough in 96.3% and respiratory problems in 33.3%. Of all the patients, 40.7% had reduced respiratory sounds on the right and 44.4% had foreign objects removed from the right main bronchus. The most commonly aspirated object was walnut. During anesthesia, the most commonly observed complication was low saturation, and laryngeal edema was most common after anesthesia.

Conclusion: Rapid and systematic evaluation and referral to a center with bronchoscopy experience are considered life-saving factors for children with a suspected aspiration of a foreign body.

Keywords: Foreign body; aspiration; children; bronchoscopy

INTRODUCTION

Foreign body aspiration (FBA) in children causes serious morbidity and is a condition requiring early diagnosis and treatment. For unexplained reasons, it is more common in male children compared to female children (1-6). If no one has witnessed aspiration, the diagnosis may sometimes be difficult. Diagnostic sensitivity and specificity of physical examination and pulmonary radiography are low, which may cause delays in removing the foreign body (FB) and increased complications (1-3). Obtaining a good history from the family is very important for diagnosis because more than 75% of cases are children from 1 to 3 years of age (5-7). Basic findings of FBA are a sudden onset of coughing, wheezing, cyanosis, and respiratory difficulty. When the diagnosis of FBA is considered, the foreign body is removed with bronchoscopy. If the diagnosis is late, the risk of complication development increases. Recurrent pulmonary infections, atelectasis, and bronchiectasis may develop due to a foreign body (2,3).

A systematic and rapid evaluation of cases with a suspected FBA has vital importance (3). In this study, the cases in our clinic who had a suspected FBA and underwent a bronchoscopy were evaluated in terms of age, gender, time of admission, history, symptoms, physical examination, radiological findings, the foreign body removed, localization of the foreign body, and complications observed during and after the procedure.

MATERIAL and METHODS

In this study, 54 patients who underwent a rigid bronchoscopy due to FBA in the pediatric surgery operating room of Hitit University Çorum Erol Olçok Education and Research Hospital between January 2010 and July 2019 were retrospectively evaluated in terms of age, gender, time of admission, history, symptoms, physical examination, radiological findings, the foreign body removed, localization of the foreign body, and complications observed during and after the procedure.

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The study was approved by the Hitit University Clinical Research Ethics Committee. The patients' physical examination findings and radiological data before the procedure were evaluated. All the patients underwent bronchoscopy under general anesthesia through a venous or inhalation induction method with anesthesia monitoring. Patients with diagnostic bronchoscopy were our exclusion criteria; these patients were not included in the study. However, no foreign body was observed in 10 patients during the bronchoscopy with the preliminary diagnosis of foreign body aspiration. These patients were followed up and referred to the pediatric chest diseases department. The ventilation-type rigid bronchoscope was used for the procedure and then the patients were admitted to the ward and monitored closely for at least one day. The patients who had complications such as low saturation, bronchospasm, or arrhythmia during or after the bronchoscopy procedure were transferred to the intensive care unit.

Statistical method

Statistical analysis of the data was performed with the SPSS (Version 22.0, SPSS Inc., Chicago, IL, USA) program. In line with data distribution, descriptive statistics are presented as mean \pm standard deviation (minimum-maximum) for continuous variables and as numbers and percentages (%) for categorical variables. The comparison of the ratio of foreign body localization according to gender was performed using the chi-square or Fisher exact test. Data normality distribution was evaluated with the Shapiro-Wilk test. The age of the children according to the complication groups was compared with the Mann Whitney U test because the data were not distributed

normally. The statistical significance level was accepted as $p < 0.05$.

RESULTS

The study included a total of 54 patients, 20 girls (37%) and 34 boys (63%). The mean age of patients was 2.74 ± 2.82 (1-12) years. Of all the patients, 59.3% came to our hospital on the same day ($n=32$), 22.2% in the first week ($n=12$), 11.1% between 1 week and 1 month ($n=6$), and 7.4% after one month ($n=4$). The complaints included cough in 96.3% of patients ($n=52$), respiratory distress in 33.3% ($n=18$), and wheezing in 33.3% ($n=18$). While 33.3% ($n=18$) had a cough and respiratory distress, 29.6% ($n=16$) had a cough and wheezing. Physical examination findings showed that 26 patients (48.1%) had reduced respiration sounds on the right, 16 (29.6%) patients had reduced respiration sounds on the left, and 12 patients (22.2%) had roughening of bilateral respiration sounds. The radiologic findings showed that the most common findings were increase in aeration on the right in 22 cases (40.7%), increase in aeration on the left in 18 cases (33.3%), and no respiration differences in 14 cases (25.9%). Generally organic materials were removed during the bronchoscopy. These included walnut in 22.2% ($n=12$), pistachio in 14.8% ($n=8$), hazelnut in 11.1% ($n=6$), sunflower seeds in 7.4% ($n=4$), and popcorn in 7.4% ($n=4$) most commonly. These were followed by roast chickpeas in 3.7% ($n=2$), chestnuts in 3.7% ($n=2$), beans in 3.7% ($n=2$), and the inorganic objects of thumbtacks in 3.7% ($n=2$) and pen lids in 3.7% ($n=2$). No foreign body was observed in 10 (18.5%) children. For the localization of foreign bodies, the most common ones were the right main bronchus for 44.4% ($n=24$) and the left main bronchus for 37% ($n=20$); 10 patients (18.5%) were found to have had no foreign body after bronchoscopy.

Table 1. Comparison of complications observed during anesthesia according to time of admission

		No complications	Low saturation	Low saturation + arrhythmia	Total	P value
Same day	n	18	12	2	32	0.509
	%	56.3	37.5	6.3	100	
First week (2-7 days)	n	8	2	2	12	
	%	66.7	16.7	16.7	100	
1 week-1 month	n	4	2	0	6	
	%	66.7	33.3	0.0	100	
After 1 month	n	4	0	0	4	
	%	100.0	0.0	0.0	100	
Total	n	34	16	4	54	
	%	63.0	29.6	7.4	100	

Fisher exact test

Table 2. Comparison of age of admission of patients according to complication groups during and after anesthesia

	Complications	N	Mean	SD	Median	Min	Max	P
During anesthesia	None	17	3.53	3.32	2	1	12	0.011*
	Yes	10	1.40	0.52	1	1	2	
After anesthesia	None	11	4.18	3.99	2	1	12	0.110
	Yes	16	1.75	0.78	2	1	3	

* Mann Whitney U test statistically significant, SD: Standard deviation

According to chi-square test results, the complications observed during anesthesia were not significantly different between the groups in terms of the time of admission ($p=0.509$) (Table 1). The ages of the children were statistically compared to the complication groups after anesthesia, which indicated no significant differences

(0.110). The age of the children was statistically different among the groups of complications during anesthesia ($p=0.011$). The mean age of the group with complications was significantly lower than the group with no complications (Table 2).

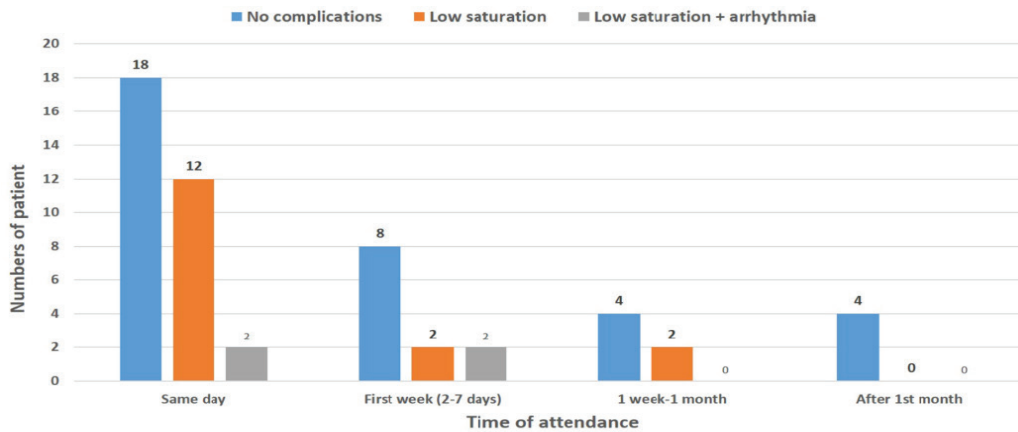


Figure 1. Distribution of time of admission and complications observed during anesthesia

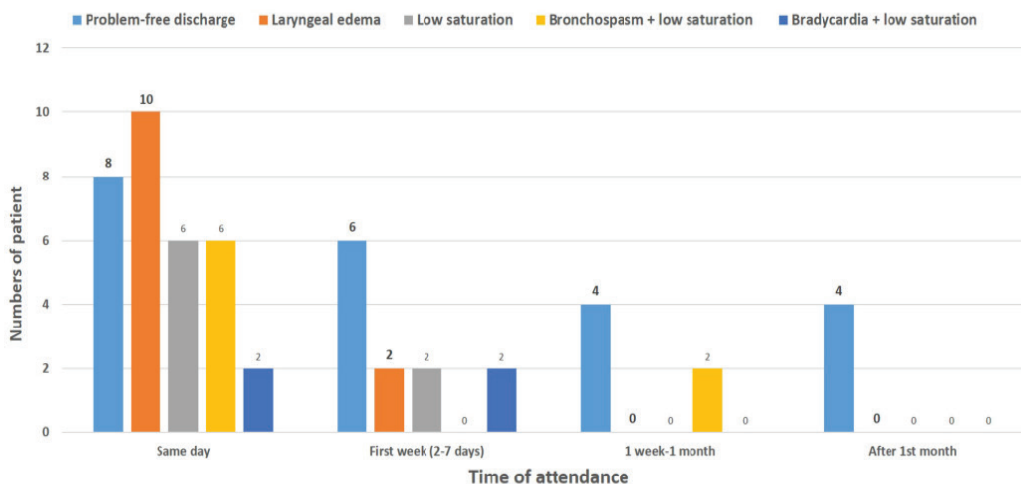


Figure 2. Distribution of time of admission and complications observed after anesthesia

All the patients underwent bronchoscopy under general anesthesia. During anesthesia, the most common complication was desaturation (SpO₂ <95%) in 16 cases (29.6%). Four cases (7.4%) had desaturation with arrhythmia, and 34 cases (63%) had no complications. After extubation, 12 cases had laryngeal edema (22.2%), 8 cases had desaturation (14.8%), 8 cases had desaturation with bronchospasm (14.8%), and 4 cases had desaturation with bradycardia (7.4%); 22 cases (40.7%) were discharged without any problems. Additionally, the patient numbers with preoperative and postoperative complications according to time of admission are presented in Figures 1 and 2.

DISCUSSION

Globally FBA is observed at rates of 84% in children under the age of 5; 75% of these children are under the age of 3 (8). The mean age of the children who had FBA in our clinic was 2.74 years, which was in line with the literature. This is because most children aged from 6 months to 3 years tend to put most things in their hands into their mouths. This age group is at risk due to their anatomic features and incomplete development of airway reflexes.

Laughing, crying, shouting and sudden movements while eating causes aspiration to occur more easily (9,10). In global literature, FBA is reported to be responsible for 7% of deaths due to accidents in children in the 1 to 3-year-old age group (7). Its incidence is reported to be two times higher in male children (11). Of the patients in this study, 63% were boys and 37% were girls. Generally, foreign bodies are organic materials such as hard shell foods (hazelnut, walnut, sunflower seeds) and legumes (chickpeas, beans) (1,3). A study conducted by Erginel et al. reported that 69% of the materials removed were organic; this rate was 73.8% in the present study, which is in line with the literature (24).

Of all the cases in this study, 59.3% came to our clinic within the first 24 hours after aspiration, 22.2% in the first week, 11.1% between 1 week and 1 month, and 7.4% after one month. The study conducted by Etensel et al. reported similar results with our study; 56% came to the clinic in the first 24 hours after aspiration and 44% after the first 24 hours (12). More than half of children with FBA saw a doctor within the first 24 hours due to the sudden development of respiratory distress (13). Families' observing cases close to choking or cyanosis due to aspiration is diagnostic (3). However, the literature reports that although 88% of children have a history of FBA, unfortunately, 19% are reported to be taken to a hospital after 1 month or longer after aspiration (14).

Just as for the 52 cases (96.3%) in our series, a sudden onset of coughing especially starting while eating and recurrent wheezy cough are the most commonly-encountered complaints (2). The most commonly encountered classic triad is known to be a sudden onset of coughing or choking, wheezing, and unilateral reduced respiratory sounds (16). These three findings are typical

of FBA and are valuable for early diagnosis. However, they are observed in less than 40% of children (7). However, in 14 to 18% of children with confirmed FBA, the first examination findings are known to be normal (17). As in 10 of our cases (18.5%), 2% are reported to discharge the foreign body spontaneously with coughing (2).

The left main bronchus is separated with a more vertical angle and has a narrower diameter in children, so aspirated objects generally tend to localize on the right side (18). Similar to previous studies, a foreign body was removed from the right side in 24 cases (44.4%) and from the left side in 20 cases (37%) in our study.

Pulmonary radiography has an important place in the diagnosis of FBA. The most frequently identified finding is trapped air on the side where the foreign body is located (11). In our series, 22 cases (40.7%) were found to have trapped air on the right, which is in line with the literature.

Bronchoscopy is the basic treatment method for FBA. Rigid bronchoscopy has advantages like being easily manipulated, having telescopic and camera systems installed easily, having a low cost, and providing good images (19).

Pediatric flexible bronchoscopes that have begun to be used recently enable easier imaging of the more distal airways. In spite of providing very beneficial information to check a distal airway that cannot be reached by the rigid bronchoscope, the most important disadvantage of this method is that it does not enable to maintain ventilation during bronchoscopy (3). Contrary to what is commonly known, bronchoscopy has serious mortality and morbidity rates that should not be underestimated. These rates are reported to be between 2 and 22% (20). A study by Tütüncü et al. also reported the most commonly observed complications as desaturation (80%), arrhythmia (72%), and hypercarbia (27%). In our study, low saturation was observed most commonly, which is in line with the literature (21). Most of the patients who came to our hospital on the same day, in the first week, from 1 week to 1 month and after 1 month were discharged without problems. No increase was identified in the complication rates observed during and after anesthesia in patients who came later; however, this finding may be related to the low number of patients who came late (Figures 1, 2).

Studies reported that respiratory distress could be increased by airway trauma and present and increasing mucosal edema in the period after bronchoscopy (21). In our study, laryngeal edema was found 22.2%, which was followed by 14.8% low saturation. Therefore, patients should be evaluated carefully; necessary treatments are recommended as oxygen and nebulized racemic epinephrine; special attention should be paid not to use steroids all the time but only when it is necessary (22).

Public health training programs are reported to reduce FBA incidence by 35% (23). In family training programs, it should be reminded that granular and hard food should

not be given to children before the age of 4, children should be fed in a sitting position and they should not be fed while crying or laughing. When families buy toys, they should consider the age groups indicated by the manufacturer. Children with siblings should be closely watched as they may give small parts of granular objects to each other.

CONCLUSION

Aspirations of a foreign body are pathologies that could easily be clinically mixed with other respiratory system problems in children. If they are not diagnosed in time and treated by experienced hands, life-threatening problems will be inevitable. Therefore, rapid and systematic evaluation and referral to a center with bronchoscopy experience are considered life-saving factors for children with a suspected FBA.

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