Araştırma Makalesi (Research Article)

Yanıbaşımızdaki Tehlike: Çocuklarda Yabancı Cisim Aspirasyonu, Önleme, Tanı ve Tedavi Değerlendirmesi

The Danger Close to Home: Foreign Body Aspiration in the Children, Prevention, Diagnosis and Treatment Evaluation

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Amaç: Yabancı cisim aspirasyonu çocuklarda sık görülür ve hava yolu obstrüksiyonuna bağlı semptomlarla ilerleyerek ciddi komplikasyonlara yol açar. Bu çalışmanın amacı şüpheli yabancı cisim aspirasyonu nedeniyle bronkoskopi yapılan hastaların uygun tanı araçlarını ve tedavi prensiplerini tartışmak ve önlenebilirliğini vurgulamaktır.

Gereç ve Yöntemler: Yazarların çalıştığı iki hastanenin Çocuk Cerrahisi Kliniklerinde Ocak 2017'den Şubat 2020 tarihleri arasında, yabancı cisim aspirasyonu değerlendirilmesi için bronkoskopi yapılan hastaların kayıtları geriye dönük olarak incelendi. Yaş, cinsiyet, yabancı cisim aspirasyonu öyküsü, klinik semptomlar, akciğer grafisi bulguları, bronkoskopi bulguları, komplikasyonlar kaydedildi. Yabancı cisim aspirasyonu öyküsü, fizik muayene bulguları ve akciğer grafisi bulguları, yabancı cisim varlığını tespit için bronkoskopi öncesi en uygun tanı aracını bulmak amacıyla istatistiksel olarak incelendi.

Bulgular: Yabancı cisim aspirasyonu şüphesi olan 102 hastaya bronkoskopi yapıldı. Hastaların% 51'inde (52/102) yabancı cisim tespit edildi. Yaş ve cinsiyet açısından istatistiksel olarak anlamlı bir fark saptanmadı (p> 0,005). Öykü ve başvuru zamanı açısından istatistiksel olarak anlamlı fark bulunurken, fizik muayene ve radyolojik bulgular açısından fark bulunmadı. Aspire edilen yabancı cisimlerin % 87'si kuruyemiş idi. Bronkoskopiye bağlı hiçbir hastada hayatı tehdit eden bir komplikasyon oluşmadı.

Sonuç: Kuruyemişler, çocukluk çağında en sık aspire edilen yabancı cisimlerdir. Hastalarda öykü, fizik muayene ve radyolojik bulguların normal olabileceği unutulmamalıdır. Önleyici tedbirler, ölümcül sonuçlar doğurabilen aspirasyon için hepsinden önemlidir. Negatif bronkoskopi oranını azaltmak için hastanın dikkatli değerlendirilmesi gerekir.

Anahtar Kelimeler: Yabancı cisim aspirasyonu, Çocuklar, Kuruyemiş,

Abstract

Objective: Foreign body aspiration (FBA) is frequently seen in children, and progresses with symptoms related to airway obstruction, leading to serious complications The aim of this study was to discuss the diagnosis and treatment principles of patients who underwent bronchoscopy for suspected foreign body aspiration, and to emphasize its preventability.

Materials and Methods: A retrospective review was made of the records of patients who underwent bronchoscopy for evaluation of FBA in the Pediatric Surgery Clinics of two hospitals where the authors work from January 2017 to February 2020. Age, gender, history of FBA, clinical symptoms, chest radiography findings, bronchoscopy findings, complications, and outcome were recorded for each patient. A history of FBA, physical examination findings, and radiological study results were analyzed statistically to determine the most accurate diagnostic toolto differentiate cases with and without FBA.

Results: Bronchoscopy was performed in 102 patients with suspected FBA. A foreign body was detected in 51% (52/102) of the patients. No statistically significant difference was determined in respect of age and gender. There was a statistically significant difference in respect of history and time of presentation, but no difference in terms of physical examination and radiological findings.Of the foreign bodies aspirated, 87% were nuts.No life-threatening complications occurred in any patient due to bronchoscopy.

Conclusion: Nuts are the most frequently aspirated foreign bodies in childhood. History, physical examination and radiological findings may not be available for all patients. Preventive measures are important as FBA can lead to fatal consequences. Careful evaluation of the patient is necessary to reduce the negative bronchoscopy rate.

Keywords: Foreign body aspiration, Children, Nuts.

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INTRODUCTION

Foreign body aspiration (FBA) is frequently seen in children, and progresses with symptoms related to airway obstruction, leading to serious complications such as cough, hoarseness, wheezing, and dyspnea in the early period, and atelectasis, abscess, bronchiectasia in the late period and can be potentially fatal. Therefore, it should be evaluated urgently and treated appropriately. More than half of the patients are one to three years old and FBA constitutes 7% of childhood fatal accidents (1-3). However, positive findings of current diagnostic tools such as history, oscultation, and chest x-ray are not usually specific to FBA and may occur in conditions mimicking FBA or may be absent in some cases. Due to the risks of overlooked FBA, even when there is a low level of suspicion or a doubtful history, bronchoscopy is performed for both diagnosis and treatment (1). However, if there are findings such as unilateral excessive aeration, pneumomediastinum, atelectasis, foreign body aspiration should be considered (4). The most important of all are protective measures in foreign body aspiration. Although the foreign body can be removed and treated with bronchoscopy, 1% of patients may have hypoxic sequelae or even irreversible complications with a mortal course. (5). Contrary to the general impression that bronchoscopy is a simple and safe procedure in children, devastating complications may occur even in experienced hands (1).

The aim of this study was to discuss the diagnosis and treatment principles of patients who underwent bronchoscopy for suspected foreign body aspiration, and to emphasize its preventability.

MATERIAL and METHODS

Approval for the study was granted by theMedical Faculty Clinical Research Ethics Committee. (Date, no: 18-03-2020 decision no: 04, session: 2020/06). A retrospective review was made of the records of patients who underwent bronchoscopy for evaluation of FBA in the Pediatric Surgery Clinics of two hospitals from January 2017 to February 2020. For patients with a history of FBA or who requested consultation because of suspected FBA due to recurrent lung infections, chest radiography was performed, and rigid bronchoscopy was performed to provide both diagnosis and treatment. Foreign bodies were removed with optical forceps.The age, gender, history of FBA, clinical symptoms, chest radiography findings, bronchoscopy findings, complications, and outcome were recorded for each patient. Statistical analysis was applied to the presence of a history of FBA, time of hospital presentation, physical examination findings, and radiologica lexamination results to determine the most accurate diagnostic tool for the differentiation of patients with and without FBA.

Statistical analysis

Data obtained in the study were analyzed statistically using SPSS 17.0 software (IBM Statistics for Windows vn. 17.0, IBM Corporation, Armonk, NY, USA). Quantitative data were expressed as mean ± standard deviation (SD), median, and range (maximum-minimum) values. Categorical data were expressed as number (n) and percentage (%).

RESULTS

Due to the suspicion of foreign body aspiration, a total of 102 patients underwent bronchoscopy under general anesthesia with a pediatric ventilated 0° optical telescope rigid bronchoscope (Karl Storz, GmbH Co. Tutligen, Germany).

Foreign body was detected in 51% (52/102) of the patients. The group with FBA comprised 67.3% males and 32.7% females with a mean age of 3.16 ± 3.34 years. The group without FBA comprised 66% males and 34% females with a mean age of 2.26 ± 2.44 years. There was no difference between the groups in respect of age and gender (p = 0.125, p=0.528). The demographic variables of the patients are presented in (**Table 1).**

The foreign body detected in 51% (52/102) of the patients who underwent bronchoscopy was located in the right main bronchus in 54% (28/52), in the left main bronchus in 38% (20/52), and in the trachea in 8% (4/52). Signs of pulmonary infection (sero-purulent secretion, mucosal hyperemia) were seen in 16 (32%) of the 50 patients without FBA and no pathology was found in the others. Symptoms such as sudden cough and choking while eating were present in 48 (92%) of 52 patients with FBA in bronchoscopy and in 18 (36%) of those without FBA. The difference between the groups was statistically significant (p< 0.001).

Of the patients with FBA, 43 (83%) presented within the first 24 hours, and five (10%) patients without FBA presented within the first 24 hours and the difference between the groups was statistically significant (p<0.001).

Normal physical examination findings were noted in 54% (27/50)of the patients without FBA and in 27% (14/52) of those with FBA (p=0.008). A foreign body was removed from the trachea immediately after a resuscitated patient (1.5 years, male) was brought to the hospital, but one day after the procedure, the patient died.

No radiological abnormality was detected on the chest x-rays of 42% (22/52)of patients with FBA and 72% (36/50) of patients without FBA(p =0.02). The most common findings in patients with FBA were unilateral hyperaeration in 67% (20/30), atelectasis in 23% (7/30) and opaque foreign body in three patients, and in patients without FBA, atelectasis at 38% (5/13), pneumonic infiltration at 54% (7/13) and pleural effusion at 8% (1/13) were the most common findings. The site of the radiological findings and location of the foreign body correlated well in 90% of the patients with FBA. The chest x-ray findings were normal in all the children with tracheal foreign bodies. No computed Tomography (CT) procedure was performed for any of the patients **(Table 2).**

The foreign body type was nuts in 87% (45/52) of the patients (peanut, walnut, hazelnut, seeds and shells of pumpkin

Table 1. Demographic variables

Variables	Group 1 n=52	Group 2 n=50	p
Age	3.16±3.34	2.26±2.44	0.125
Gender(Female n,%)	17 (32.7%)	17 (34%)	0.528

Data are expressed as mean ± SD, unless otherwise noted. Categorical data are expressed as n (number). Independent T Test(Bootstrap), Pearson Chi-Square Test

Table 2. Comparison of the history of aspiration, preseentation at hospital on the first day ,physical examination and radiological evaluation according to bronchoscopy findings for foreign body aspiration (FBA).

Variables	FBA + (n=52)	FBA – (n=50)	P
Family witnessing the event	48 (92%)	18 (36%)	< 0.001
Presentation at hospital on the first day (n /%)	43(83%)	5 (10%)	< 0.001
Normal physical examination findings	14 (27%)	27 (54%)	0.008
Radiological findings suggestive of FBA (n/%)	30 (58%)	14 (28%)	0.02

FBA: Foreign Body Aspiration

and sunflower). Other foreign bodies (13%) were metal hairpin, pin, rice, and chicken meat. In two patients aged 23 days and 14 years, awire guide and pin were removed by thoracotomy as they could not be removed by bronchoscopy. A single application of bronchoscopy was applied to all the patients, and none required bronchoscopy again. No life-threatening complications occurred in any patient due to bronchoscopy.

DISCUSSION

Although foreign body aspiration may be detected at any age, it is more common in children aged <four yearswith a predominance of male gender (6). At this age, children want to put everything into their mouth, and the neuromuscular mechanisms that separate the airway and esophagus have not yet matured [4]. Consistent with the literature, the cases in the current study were in a similar age range, with mean age determined as 3.16 ± 3.34 years in patients with FBA and 2.26 ± 2.44 years in those without FBA. The male/female ratio was determined as 35/17 in the groupwith FBA. Preventive measures should be taken especially in this age group.

Rigid bronchoscopy under general anesthesia is performed in the presence of clinical and radiological findings. Different series have reported that no foreign body could be detected with rigid bronchoscopy in 16–57% of cases when applied on suspicion of FBA and the rates of positive bronchoscopy reported in the literature range from 30% to 90% (6). The current study findings in respect of the distribution of patients with FBA (51%) and without FBA (49%) were seen to be consistent with literature.

Bronchoscopy not only exposes the child to the risks of anesthesia but may also have perioperative complications such as bronchospasm, desaturation, edema and bleeding . Therefore, Özyüksel et al. recommended a scoring system to decrease the negative bronchoscopy rate andconcluded that although radiological findings and physical examination were strong parameters for positive bronchoscopy, FBA history had no diagnostic benefit. In a study by Tutuncu et al., cough was detected in 88% of patients and a unilateral decrease in respiratory sounds in 33% of patients (7). Sarısoy et al. reported a unilateral decrease in respiratory sound in 63% of the patients (8). In the current study, there was no statistically significant difference between the patients with and without FBA in respect of the physical examination and radiological findings.When examined in terms of a family member having witnessed the event, there was a witness in 92% of the cases with FBA and in 18% of thosewithout FBA, and the difference between the groups was determined to be statistically significant. Çiftçi et al strongly emphasized that if the aspiration had been witnessed and the history appears reliable, then bronchoscopy is invariably indicated on the basis of the history alone even when symptoms are minimal and imaging studies are negative. The findings of the current study also support this view.

The period between onset of the symptoms and presentation at hospital for FBA cases has been reported to be 48 hours, and even if the patient is seen in the early period, other diagnoses may be made (8-10). In the current study, the rate of admission to hospital on the first day was 83% for cases with FBA and 10% for those without FBA, and the difference was statistically significant. It can be concluded that further examinations would be beneficial to reduce the rate of negative bronchoscopy in patients who present after the first day. From the results of the current study, it was concluded that the rate of FBA presentation was high in patients presenting with acute and witnessed aspiration history.

Scientific dataprovides different statistics for aspirated objects (11). However, aspiration is more common on the right side because of the anatomy of the bronchial tree. Tütüncü et al. detected foreign bodies on the right and left side in 49% and 24% of cases, respectively (7). Özsoylu reported foreign body in the right bronchus in 53% of the patients, and in the left bronchus in 15% of the patients (12). In the current study, foreign bodies were detected in the right bronchusat the rate of 54%, in the left at 38%, and at 8% in the main bronchus.

Lung X-ray is ordered routinely before bronchoscopy in case of foreign body aspiration. Hyperaeration, unilateral and/or localized hyperlucency, shift in mediastinum and opaque foreign bodies can be seen in positive cases. Radiological findings can occur both with and without a foreign body, therefore, although radiological examination is routine in FBA, it has little value in the differential diagnosis between FBA and respiratory tract infection (1). The sensitivity and specificity of chest X-rays has been reported as 62% and 57% respectively (6). Previous reports have documented normal chest x-rays in 18% to 60% of patients with FBA (1). In the current study, X-ray findings were normal in 42% of the cases with FBA. This is also compatible with the data literature. In a study by Çiftçi et al, the normal radiological findings in 12% of the cases with FBA were attributed to the fact that most of the patients presented at more than two days after the event (1). In the current study, most of the patients presented on the first day.

Some authors have suggested the use of CT in unconfirmed FBA cases (13-15). Some studies have suggested that the use of CT scans decreases the rate of negative bronchoscopies (6). In the current study, CT was not performed on any patient. A selective approach should be adopted for CT, as it should be avoided as much as possible to prevent radiation exposure and the possible development of cancer, as children are more vulnerable to radiation than adults. Furthermore, anesthesia and bronchoscopy may also be needed after detection of a foreign body. Therefore, CT scans were not preferred in this study. Virtual bronchoscopy may also be performed for diagnostic purposes. However, since the patient is exposed to a significant amount of radiation through spiral CT in virtual bronchoscopy, it should only be performed on selective eligible cases. This method should be applied to patients who do not accept bronchoscopy under general anesthesia, and those with an unclear medical history and problematic indication (16). Virtual bronchoscopy was not applied to any patient in the current study.

According to June 2014 data of the Turkish Union of Chambers and Commodity Exchanges, there are 1,289 companies for dried nuts and fruits registered in the industrial database in Turkey (17). This may give an idea about the prevalence of nut consumption. The aspirated objects are associated with the socioeconomic status of the country and age of the patient. The most common foreign bodies aspirated include nuts (48%), fruit and vegetable particles, and toys. However, plastic materials such as small toy parts are usually aspirated by children aged > 3 years (10). Çiftçi et al. reported that in 75% of cases, the aspirated material was organic (1). In line with the literature, the most common foreign body aspirated was nuts (87%) in the present study. Other inorganic material was detected less in this study. Therefore, consumption of such foods should be avoided in environments with young children, and families should beeducated about this issue.

Since clinical presentation, symptoms and direct X-rays were not sufficient for diagnosis, negative bronchoscopy rates have been reported in the range of 16% to 57% in the literature (18, 6). Özsoylu et al. detected negative bronchoscopy prevalence as 38% (12). In the present study, the negative bronchoscopy rate was 49%, which is in line with the literature. Negative bronchoscopy rates may be associated with insufficiency of the evaluation through both clinical and radiological evaluation for diagnosis in FBA cases. In order to prevent this, medical history taking, and physical examination should be performed very carefully.

The basic diagnostic and therapeutic method for FBA is bronchoscopyperformed using rigid or flexible bronchoscopes. Rigid bronchoscopy is a diagnostic and therapeutic procedure with an approximate success rate of 100% in experienced hands, and a complication rate of 2% to 8% (19). Bronchospasm, edema, pneumothorax, hypoxia, and tracheobronchial injury may be observed during rigid bronchoscopy (6). Late-term complications may include granuloma, atelectasis, abscess, and fistula. However, the complication rates decrease when the procedure is performed by an experienced physician. Complications during bronchoscopy usually develop because of technical faults and inadequate indications (19). In the current study, no complications were experienced during bronchoscopy. However, in all series of FBA, the mortality rate has been reported to be 3% - 4% depending on the localization and nature of the foreign body (20,21). The mortality rate of FBA was 1% in the present study. The retrospective design and low number of patients are the most important limitations of this study. In the light of these findings, there is a need for further prospective studies with more patients to be able to clarify the diagnosis and treatment of FBA.

As a conclusion, Foreign body aspirations should be suspected when there is a history of cough with sudden onset while eating something, abnormality detected by auscultation and radiological imaging, or persistent pulmonary infections. Witnessing of the event by the family and first day presentation are important findings that support FBA. In these cases, rigid bronchoscopy is the gold standard for diagnosis and treatment. However, as some complications of FBA may be irreversible, the most important issue to be considered is the taking of preventive measures and the education of families.

Conflict of Interest and Financial Status

The authors declare that there is no conflict of interest to declare. The author(s) received no specific funding for this work.

Research Contribution Rate Statement Summary

The authors declare that, they have contributed equally to the manuscript

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