

Anemia and Foreign Body Aspiration in Pediatrics

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ABSTRACT

Introduction: Foreign body aspiration (FBA) is a life threatening medical condition and considered a surgical emergency in patients with acute symptoms. Eating disorders like pica may increase the rate of foreign body ingestion especially in toddlers with immature airway protective reflexes. Iron deficiency is the common cause of both pica and anemia in infancy and this article evaluates the incidence of anemia among patients with FBA.

Materials and Method: Medical records of 141 children with aspirated foreign body were reviewed. Control group consisted of patients who had been operated because of inguinal hernia considering the same exclusion criteria and age range and sex distribution. RBC indexes were assessed and incidence of anemia was evaluated and compared between FBA patients and control group.

Results: Anemia according to age matched Hemoglobin was observed in 34.8% of FBA cases and 15.6% in control group so anemia in FBA group was significantly more common than control group.

Conclusion: Screening and early detection of IDA in childhood, especially in high risk group should be considered a public health care priority to prevent its direct or indirect life-threatening complications such as foreign body aspiration.

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Introduction

Foreign body aspiration (FBA) is considered a surgical emergency and may cause sudden death in infancy (1-3). Patients with incomplete airway obstruction due to un-witnessed FBA may manifest with nonspecific respiratory symptoms and be managed with the diagnosis of asthma or

pneumonia for years and finally turn to acquired chronic lung disease (4-6).

Unfortunately most of FBAs are un-witnessed in toddlers that cannot explain the problem so this diagnostic challenge may lead to mismanagement, several morbidities and imposes costs to the family or health care system (7, 8).

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Toddlers used to explore the environment or feel foreign objects with hands and mouth and this oral phase considered as a normal developmental stage. On the other hand, immature gag reflex and pharyngeal discoordination and poor airway protection beside their trend to cry put them in a high risk for foreign body aspiration. Some of these cases are also victims of child abuse and ignorance (9).

Several preventive strategies have been suggested such as public education, standardization of toy's objects and health care awareness but FBA remains still a challenge for care givers and health care system (9).

Pica is defined as an eating disorder mostly in young children that characterized by persistent compulsive cravings to eat non nutritive substances. It is reported that 10-30% of 1-3 year old children have this behaviors that may dramatically increase the risk of FBA and related morbidities (10,11). This article aimed to evaluate the incidence of anemia as a correctable cause of pica among patients with FBA.

Materials and Methods

All patients (from 6 month to 6 year old) with documented FBA in rigid bronchoscopy were included and evaluated retrospectively and compared with control patients who were admitted for emergent herniotomy in the same time period with similar age range . We reviewed the health records of FBA cases during a five year period (2006-2011) in the registry of our academic referral pediatric surgery center. 150 FBA cases who underwent rigid bronchoscopy were enrolled. Patients with hematologic and hemolytic

diseases or chronic respiratory problems such as pneumonia or bronchiectasia or chronic asthma or those with neurologic disabilities such as cerebral palsy or other comorbidities were excluded so our case group was limited to 117 previously asymptomatic babies with acute FBA. Control group consisted of patients who were admitted for emergent herniotomy in the same time span considering the same exclusion criteria. Age range and sex distribution of control group was matched with the FBA group. The control group was limited to 76 cases as the red blood cell profile were not checked routinely for emergent herniotomy.

RBC indexes had been assessed in all cases before surgical intervention and patients with hemoglobin and hematocrit level out of normal aged match range (Table 1) were considered as anemia cases according to the hemoglobin and hematocrit nomogram (9-13).

Our data source was Cell Blood Count of patients as a routine pre-operative laboratory study in the patients' electronic medical record. As data collection wasn't objective or subjective dependent so we didn't have information bias. We predicted a selection bias as some candidates of elective herniotomy might be canceled because of anemia and postponed until hematocrit correction so we searched the records of control group considering the diagnosis at the time of admission wither the operation was done or canceled. Finally we compared the RBC indexes and rate of anemia between FBA patients and control group by SPSS (version 11.5) software using independent T test and Chi square test.

Table 1. Normal values for hematologic parameters in children

Age	Hemoglobin (g/dL)		Hematocrit (%)		
	Lower limit	Upper limit	Lower limit	Upper limit	
6 months to <2 years	11.0	13.5	31	42	
2 to 6 years	11.0	13.7	34	44	
6 to 12 years	11.2	14.5	35	44	
12 to <18 years	Female	11.4	14.7	36	46
	male	12.4	16.4	40	51

Results

117 patients in FBA group and 76 patients in control group met the inclusion criteria. Rigid bronchoscopy demonstrated FB in right main bronchus in 43 cases (36.7%), left main bronchus in 35 cases (29.9%), trachea in 32 cases (27.4%) and in both main bronchus in 7 patients (6%) among patients with FBA.

The most common foreign bodies were seeds and nuts in 52 (44.5%) and 42 (35.8%) patients respectively. Other nutrients were aspirated in 9 patients (7.7%) and non-nutrient substances were detected in 14 cases (12%).

Comparing FBA and control group, mean age was 19.36 ± 17.21 months in FBA and 17.51 ± 7.32 months in the control group (T test P value=0.41) and boys to girls ratio in FBA group was 78/63 compare to 76/46 in control group (Chi square P value=0.25).

Demographic data and blood cells indexes were compared between FBA and control group and the results are shown in table 2.

Anemia was detected in 41 (35%) and 38 (32.5%) patients respectively in FBA group.

Anemia regarding age matched hemoglobin and hematocrit nomograms was seen in 11 (14.5%) and 10 (13.2%) respectively in control group.

Comparing the incidence of anemia among children undergone emergent intervention for FBA or herniotomy (control group), anemia was significantly more common in FBA group (table 3).

Discussion

Foreign body aspiration is common among 1-4 year old children and may be a cause of accidental death in infancy with the annual mortality of 300-2000 in the US (13). High level of suspicious is needed for early diagnosis of most un-witnessed FBAs as the symptoms are often nonspecific. Respiratory symptoms are more common although even imaging may not be helpful always and rigid bronchoscopy remains the best diagnostic and therapeutic tool.

Table 2. Blood cells indexes among patients with foreign body aspiration and control group.

Blood cell index	FBA patients	Control group	P value*
WBC	13569±4700	12701±6900	0.327
Hb (mg/dl)	10.37±1.38	11.73±2.19	<0.01
Hct (%)	31.14±4.29	34.27±5.28	<0.05
Plt	380709±123151	340841±231719	0.23
RBC	$4.1 \times 10^6 \pm 0.47 \times 10^6$	$4.6 \times 10^6 \pm 0.23 \times 10^6$	<0.05
MCV	76.3±6.54	89.4±7.21	<0.001
MCH	42.2±2.72	56.7±7.92	<0.05
MCHC	30.1±1.93	34.7±4.31	<0.01

* Independent t test P Value

-WBC: White blood cells - Hb: Hemoglobin - Hct: Hematocrit - Plt: Platelet

- RBC: Red blood cells - MCV: Mean corpuscular volume - MCH: Mean corpuscular hemoglobin

- MCHC: Mean Corpuscular Hemoglobin Concentration

Table 3. Incidence of anemia according to hemoglobin and hematocrit level considering age matches nomogram among patients with foreign body aspiration and control group.

RBC index	FBA group (N=141)	Control group (N=122)	P value*
Hb level 2sd less than normal	50 (34.8%)	19 (15.6%)	<0.01
Hct level 2sd less than normal	47 (33.3%)	14 (11.5%)	<0.01

* Chi square test P Value

Several predisposing factors are suggested for FBA such as age, gender, socioeconomic condition, inappropriate toys and trend to oral exploration in infancy.

Pica is an eating disorder as a compulsive willing to put objects in mouth that is more common in infants and young children. Mineral deficiency and specially anemia suggested as a cause of pica (14). Abnormally increased eager to put the objects in the mouth among infants with undeveloped air way protective mechanisms may put them in a high risk of FBA and its morbidities

In this study we assessed the incidence of anemia as a correctable cause of pica among patients with foreign body aspiration compare to control group. Anemia and pica are both common in infancy especially in communities with poor health care and malnutrition. Prevalence of anemia among 1-6 year old children was reported as 18.2% in Iran (12) and about 3%-46 % in the literature worldwide (13-15). The prevalence of anemia according to WHO report is almost 55% in Africa and North Asia, 25% in Latin America and Eastern Asia, 15% in Europe and 8% in North America. Anemia is also reported in 12% and 51% of children in developed and developing countries respectively (16) while the prevalence of Iron deficiency is much higher (15).

Iron deficiency is the most common cause of anemia in infancy and the main potential cause of pica as a risk factor for foreign body ingestion. The most common aspirated objects are nuts and seeds (17-19) although non nutrient objects such as small toy particles are also reported repeatedly. Considering the morbidities of FBA and the costs that miss or delayed diagnosis may impose to the family and health care system, it is important to focus on preventive steps to decrease the rate of FBA. Toy standardization, public and medical staff education are among these preventive strategies.

Our results in this retrospective study showed a significant higher incidence of anemia in patients with FBA compare to control group that suggests the anemia as a correctable risk factor for pica and FBA. Although iron supplement therapy is suggested in all infants but the rate of anemia

is still considerable in infancy (20, 21). Poor feeding, low socioeconomically status, ineffective health care policies and services, cow milk nutrition or prolonged exclusive breast feeding and populated families are among risk factors for Iron deficiency anemia (IDA) (16) that is considered a major public health issue in all countries yet. Several complications are associated with IDA including fatigue, impaired physical and cognitive development, heart failure, cerebrovascular events and infections (22, 23).

This study revealed another aspect of anemia and iron deficiency in infancy as a risk factor for foreign body ingestion.

Our limitation was a selection bias as some candidates of elective operative intervention might be postponed because of anemia so the actual rate of anemia may be higher in both groups.

Conclusion

According to our findings, screening and early detection of IDA in childhood, especially in high risk group should be considered a public health care priority to prevent its direct or indirect life-threatening complications such as foreign body aspiration.

Abbreviations

FBA: Foreign Body Aspiration, **RBC:** Red Blood Cell, **Hct:** Hematocrite, **Hb:** Hemoglobin, **sd:** standard deviation, **IDA:** Iron deficiency anemia.

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