Mohammad M. AL-Shamsi et al /J. Pharm. Sci. & Res. Vol. 10(1), 2018, 214-217

ISSN:0975-1459
Journal of Pharmaceutical Sciences and Research
www.jpsr.pharmainfo.in

The frequency of anemia in Iraq children with atopic diseases

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Abstract

Background: Atopic diseases are linked with chronic inflammations, avoidance of food that cause allergy, and uses of systemic immunosuppressant medications. All these factors have been shown to increase the frequency of anemia.
Objectives: To investigate the frequency of anemia in children with atopic diseases.
Patients and Methods: In this case-control study, a total 200 children were involved in this study. They are attending the maternity and children teaching hospital in AL-Diwaniya city. One hundred children are presented with atopic disease (case data) and another one hundred as healthy children (control data). The age of children is ranged from (0.5 years to 14 years). Analysis of the data was conducted from 1st of Feb. 2016 to 1st of Sept. 2016. Complete blood count and blood film were done for all children.
Results: In current study we found that the frequency of anemia is high among children with atopic disorders than in healthy children, there was a significant difference found in the mean Hb levels between atopic cases (11.12 ± 1.22 g/dl) and control cases (12.14 ± 1.09 g/dl) (P=0.001). Additionally, the results revealed that asthma is associated with higher frequency of anemia (P-value=0.007) among other atopic disorders as defined by laboratory results. Whereas eczema, hay fever, and food allergy are not linked with anemia generally. There were statistically significant differences between atopic diseases and controls group with respects to the body mass index (BMI) (P=0.001), family history (P=0.002) and consanguinity (P=0.001). **Conclusion**: This study shows the frequency of anemia was significantly higher in children with atopic diseases compared with healthy children.

Keywords: Anemia; Atopic diseases; Chronic inflammations; Body mass index (BMI)

INTRODUCTION

The word atopy (Greek: atopia, out of place) refers to an inherited tendency to produce immunoglobulin E (IgE) antibodies in response to small amounts of common environmental proteins such as pollen, house dust mite, and food allergens. The presence of atopy in an individual is associated with an increased risk of developing one or more of the atopic diseases _atopic dermatitis, asthma, and allergic rhinoconjunctivitis/ hay fever and food allergy [1]. Atopic diseases are the most common chronic conditions in childhood, and the prevalence is still increasing in many countries [2]. During the past decade's atopic diseases have increased markedly in prevalence not only in most western countries but also in many developing countries [3]. The exact causes of such a rise are poorly understood. However, viral infection with "asthmogenic" viruses in early childhood [4]. Environmental pollution [5], changes in lifestyle, and evolving dietary habits have been suspected in genetically susceptible/high-risk patient population [6]. It was recently proposed that anemia may explain some part of this pattern [7].

The clinical features of the disease allow us to distinguish two types of asthma: atopic and non-atopic. Apart from being pathologically indistinguishable, both types of asthma are characterized by reversible airflow obstruction, wheeze with exertion, diurnal variation of bronchial tone and eosinophilia in sputum and peripheral blood [8].

Atopic dermatitis is primarily a disease of early childhood. About 20% of all children develop symptoms of atopic dermatitis at some point in their lives [9]. About 30% of all children with atopic dermatitis have a food allergy. The allergens involved are typically cow's milk and egg with other foods also being common, for example, soy, wheat, and fruits. The risk of other atopic diseases, primarily asthma, and hay fever is markedly increased in children with atopic dermatitis. A child with moderate to severe atopic dermatitis has a 50% risk of developing asthma, either concomitantly or in later life, whereas the risk of developing hay fever is as much as 75% [10]. More than 170 foods have been reported to cause IgE mediated reactions, but the allergens most commonly involved are cow's milk, egg, nuts, fish, and shellfish [11].

Anemia is a condition in which the number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the body's physiologic needs. Specific physiologic needs vary with a person's age, gender, residential elevation above sea level (altitude), smoking behavior, and different stages of pregnancy. Iron deficiency is thought to be the most common cause of anemia globally, but other nutritional deficiencies (including folate, vitamin B12 and vitamin A), acute and chronic inflammation, parasitic infections, and inherited or acquired disorders that affect hemoglobin synthesis, red blood cell production or red blood cell survival, can all cause anemia [12].

The occurrence of anemia and atopic diseases is a rising subject of interest in the recent years. In inflammatory diseases, cytokines like IL-1, IL 6 and TNFa are secreted in conjunction with bacterial lipopolysaccharides. These mediators induce the production of hepcidin by the liver. It is now known that hepcidin inhibits duodenal absorption of iron as well as iron release from macrophages [13]. This subsequently leads to the decreased availability of iron for erythroid progenitor cells, thus turning RBC production towards iron-restricted erythropoiesis mimicking true iron deficiency. Ferroportin is also downregulated by the proinflammatory stimuli, further blocking the release of iron from macrophages. In patients with anemia of chronic disease, the proliferation and differentiation of erythroid precursors are impaired by IFN-a1, -b1, -g1, TNF-a, and IL-1. IFN-g appears to be the most potent inhibitor of these inflammatory cytokines. In summary, chronic inflammation leads to anemia in three different ways: first, at the iron level, second at the EPO-EPO receptor level and finally at the erythroid precursor level. Atopic disease is associated with chronic systemic inflammation [14]. Childhood atopic diseases are associated with multiple comorbid chronic health conditions, including impaired sleep, obesity [14], hypertension and cardiovascular disease [15], extracutaneous infections [16] and depression, anxiety, and multiple other mental comorbidities [17]. All these factors have been shown to be associated with anemia. In addition, children with moderate to severe eczema are often treated with long-term immunosuppressant medications, such as methotrexate and cyclosporine, which can cause anemia and other hematologic abnormalities. Yet, a little is known about whether atopic diseases

are associated with increased risk for anemia. So the current study was aimed to investigate the frequency of anemia in children with atopic diseases in Diwaniyah, Iraq.

Patients and Methods

This case-control study was conducted on 200 children in the age group of 6 months to 14 years attending the maternity and children teaching hospital in Diwaniyah (180 km south of Baghdad, Iraq) during the period from February 1st, 2016 to September 1st, 2016, an informed verbal consent was obtained from all parents who agreed to participate in this study. A detailed history and clinical examination were done on every patient; asthma was diagnosed by clinical examination together with applying the following criteria [18].

1. Episodic symptoms of airflow obstruction
2. Airway obstruction was at least partially reversible
3. A history of more than three episodes
4. An alternative diagnosis was excluded

The diagnosis of other allergic diseases as allergic rhinitis, atopic dermatitis, urticaria and food allergies was based on physician diagnosis. The study group involved 100 patients with atopic diseases and 100 children as a control group of a comparable age, the control group were randomly allocated from healthy children attending the hospital for vaccination or accompanying their sick siblings. Children with a history of prematurity, chest wall malformation, chronic diseases, severe systemic illness, intake of iron supplementation and a history of infection were excluded from the study. Information was obtained concerning age, gender, residence, and consanguinity. The weight, length or height and body mass index (BMI) were measured using standardized methods, the calculation of BMI was done by dividing the weight in kilograms on height meters squared. The blood samples were analyzed in the hospital lab for complete blood count and blood film, the cutoff point for low hemoglobin level was 11 g/dl; meeting the definition of anemia by the world health organization (WHO) [19], the data were analyzed using statistical package for the social sciences software (SPSS) program, a P value of less than 0.05 were considered to be statistically significant.

Results

The majority of the study and control group were males (132;69.2%), the females were 68 (30.8%), the sex distribution and the male predominance in both groups are shown in figure 1.

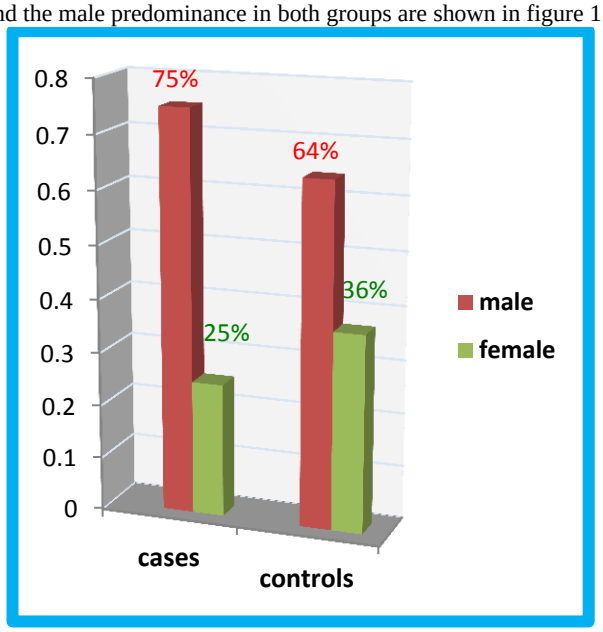

Fig.1: Male and female predominance in the cases and control groups

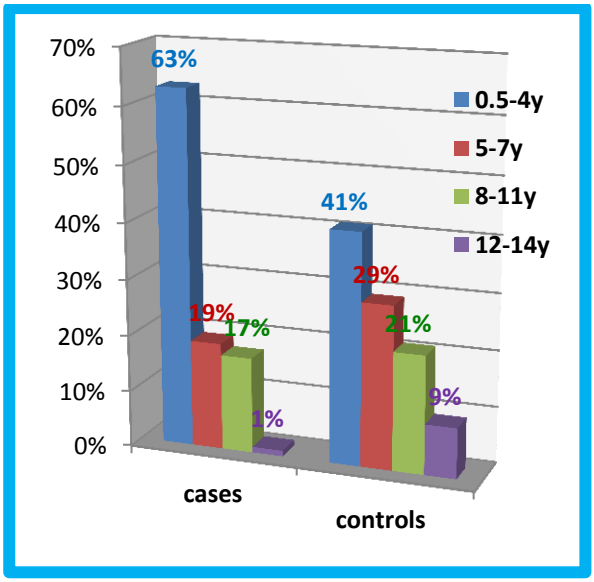

Fig.2: Age distribution of the study groups

Most of the patients and control group children were less than 4 years of age (figure 2)

Figure 3 represents the frequency of atopic diseases in the study group where asthma was the most common (61%) followed by eczema, rhinitis and food allergy.

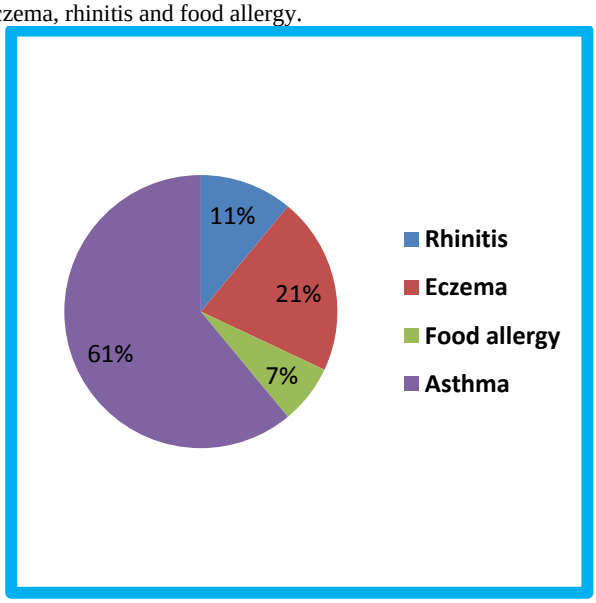

Fig. 3: Distribution of atopic diseases

The frequency of anemia was statistically significant in the group of patients with atopic diseases in comparison with the control group (Table 1)

Table 1: The frequency of anemia in the cases and the control group

	Anemia	No anemia	Total	p-
Case	53	47	100	0.001
Control	21	79	100	

Hypochromic microcytic anemia was the predominant type of anemia in the patient's group (69%). Anemia was mostly observed in patients with asthma than other atopic diseases, table 2 demonstrate the frequency of anemia in patients with atopic diseases.

Table 2: Distribution of anemia in patients with atopic diseases

	Anemia	No anemia	Total	p-value
Rhinitis	2	9	11	
Eczema	11	10	21	
Food allergy	1	6	7	
Asthma	39	22	61	0.007

There was a statistically significant difference between the control group and the group of patients with atopic diseases concerning BMI, Family history of atopic diseases and consanguinity (table 3)

Table 3: Sociodemographic characteristics of the control and the patient's group

		Case	Control	Total	p-value
BMI	underweight	26	10	36	0.001
	normal	46	74	120	
	overweight	13	11	24	
	obese	15	5	20	
Family history	Positive	75	19	94	0.002
	Negative	25	81	106	
Consanguinity	Positive	27	9	36	0.001
	Negative	73	91	164	

DISCUSSION

In this study, the childhood asthma is associated with higher incidence anemia (P-value=0.007) among other atopic disorders as defined by laboratory assay test results. In contrast, eczema, hay fever of, and food allergy are not associated with anemia overall. Few epidemiological studies have reported a similar finding that anemia is associated with an increased incidence of asthma and allergy symptoms [20,21,22]. In current study, the mean Hb levels in atopic cases was (11.12 ± 1.22 g/dl) and (12.14 ± 1.09 g/dl) in control children (P=0.001), which is agree with the study done in Qatar, they found the Qatari children with asthma and allergic diseases experienced high prevalence of anemia than in healthy children, there was a significant difference found in the mean values of Hb levels between asthmatic (10.58 ± 3.05 g/dL) and control children (11.75 ± 3.10) (P = 0.006) [23]. In a study done in United, states show the childhood asthma and eczema were associated with higher odds of microcytic anemia. Atopic diseases have been shown to be associated with several different comorbid conditions, many of which are known to increase the risk for anemia. The chronic inflammation present in an atopic disease, use of systemic immunosuppressant medications, increased use of alternative medicines [24], and increased incidence of malnutrition [25] are examples of such comorbidities.

The restrictive diets followed by many patients with a suspected food allergy or apparent exacerbation of skin or airway disease brought on by specific food has been hypothesized to play a role in malnutrition seen in patients with atopic diseases. It has been established that diet devoid of milk or milk products and other crucial food can lead to malnutrition [25].

Iron deficiency anemia might occur secondary to food avoidance and malnutrition. Iron affects the components of the immune system including the numbers and functions of lymphocytes and granulocytes [26] It determines the balance between and the intensity of Th1 and Th2 arms of the immune response and leads to a deviation toward Th2 response [27]. It is known that Th2‐twist of immune response favors the development of allergic diseases.

On the other hand, the association between the atopic diseases and microcytic anemia may be owing to anemia of chronic diseases (ACD). This possibility may explain why a higher number of atopic disorders was associated with increased incidence of anemia. Previous studies found that children with atopic dermatitis as well as asthma and hay fever (so-called extrinsic diseases) [28], and children with more severe atopic dermatitis are more likely to carry a mutation of the Filaggrin gene. Nevertheless, anemia was associated with eczema even in the absence of allergic diseases (i.e., intrinsic eczema). These findings suggest that chronic inflammation occurring in eczema may contribute to ACD [14]. Yet, there is a paucity of data examining the association between atopic diseases and anemia.

CONCLUSION

The frequency of anemia was significantly higher in children with atopic diseases compared with healthy children. Childhood asthma was associated with higher incidence of anemia as defined by laboratory assay test results. To the best of our knowledge, the present study is one of the few studies evaluating Hb level in asthma and allergic diseases, and the first one to be current among children in the maternity and children teaching hospital in AL_Diwanyia city, Iraq.

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