Original Research Article

Comparative Study of White Blood Cell, Percentage of Peripheral Eosinophils and Absolute Eosinophil Count between Asthmatic and Non Asthmatic Patients

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Abstract

Background: Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. In this study, we wanted to compare the percentage of peripheral eosinophils in clinically diagnosed children of asthma with the non-asthmatic children below 12 years of age and assess the various risk factors that cause asthma. **Methods:** This was a case control study conducted at Niloufer Hospital for Women and Children, Osmania Medical College, Hyderabad over a period of 1 year from October 2018 to September 2019 among 100 children (asthmatic – 50, non-asthmatic – 50). The collected data was entered into Microsoft Excel sheet-2010 and data was taken into IBM statistical package for social sciences (SPSS) statistic for windows, version 24.0. T-test was used to compare the means of two groups. **Results:** In asthmatic patients, the eosinophil means ± SD was 5.51 ± 2.63 and in patients without asthma, the eosinophil means ± SD was 2.04 ± 1.58. Statistically there was difference between eosinophil percentage in asthmatic and non-asthmatic. **Conclusion:** In this study, none of the children presented with severe persistent asthma, excluding it from the study. Routine investigations like complete blood picture, haemoglobin, white blood cells, eosinophil percentage and absolute eosinophil counts were measured in both asthmatic and non-asthmatic children. Absolute eosinophil count and eosinophil percentage were significantly higher in asthmatics than in non-asthmatic children. Blood eosinophil percentage and absolute eosinophil count can be considered as early indicators for asthma.

Keywords: Peripheral Eosinophils, Absolute Eosinophil Count, Asthmatic, Non- Asthmatic

Introduction

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role on mast cells, eosinophils, T-lymphocytes, macrophages, neutrophils, and epithelial cells. In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment. The inflammation also causes an associated increase in the existing bronchial hyper responsiveness to a variety of stimuli. The approach to eosinophilia is largely based on clinical history. Often, few aspects of a case, alert the clinician as to the likely underlying cause of abnormally elevated eosinophils. However, at times, more significant investigations need to occur to more clearly define the cause of their presence and possible role in disease presentation [1].

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Chronic sinusitis, especially of the polypoid variety seen in aspirin-exacerbated respiratory disease, produces a more robust eosinophilic response that can be in the mild to moderate range. Often these patients start with nasal allergies and asthma, but then develop abnormal arachidonic acid metabolizing cascades and hence have a more dramatic presentation both of their disease entity and of the eosinophilia [2,3].

Eosinophils represent up to 6% of the bone marrow resident nucleated cells and are routinely measured as part of the full blood cell count. When eosinophil absolute count exceeds 450–500 cells/μl, the term eosinophilia applies. Non-asthmatic eosinophilic bronchitis is a chronic disease and was first described in a small group of patients by Gibson et al. in a relatively recent date. Without bronchospasm, it is defined as eosinophilic inflammation of the respiratory tract and is usually associated with eosinophilia in sputum. It is one of the most important causes of chronic cough [4,5].

When a cough lasting longer than 8 weeks is detected in clinical practice and the chest X-ray is normal, this situation is defined as chronic cough. Chronic cough is a common cause of complaints all over the world, especially at the centers giving outpatient care, and is responsible for about 40% of the applications. However, the cause(s) leading to this condition can be detected in 75–90%. Non-asthmatic eosinophilic bronchitisis a disease that should be remembered in the differential diagnosis of chronic cough, but it is often ignored.

Because the systematic examination of bronchial inflammation can be made rarely, it is probably diagnosed less than it exists [6].
Hence the present study was carried out to compare the WBC, percentage of peripheral eosinophils and absolute eosinophil count between asthmatic and non-asthmatic children below 12 years.

Materials and Methods

This was a case control study conducted at Niloufer Hospital for Women and Children, Osmania Medical College, Hyderabad, Telangana over a period of 1 year, from October 2018 to September 2019 among 100 children (asthmatic – 50 as cases, non-asthmatic – 50 as a controls).

Inclusion Criteria

1. Family history of bronchial asthma
2. Family history of allergic rhinitis
3. Past history of similar complaints with prompt relief with inhaled short acting beta agonists
4. Wheeze episode precipitated by dust, intake of cool items, seasonal variation, exercise etc
5. Past history of atopic eczema.

Exclusion Criteria

1. Wheeze with clubbing, failure to thrive, heart disease
2. Monophonic wheeze.
3. Wheeze due to respiratory tract infections, congenital malformations of lung.

Children between 3 to 12 years with clinical diagnosis of asthma were selected. These children were newly diagnosed with asthma at out-patient department (OPD). Age matched controls without any history of respiratory symptoms, asthma and allergy are selected. Data for the study was collected in a pre-tested proforma which included various parameters like age, sex, identification number, detailed history regarding the symptoms. Further history in cases group regarding number of exacerbations, hospital admissions, tuberculosis (TB) contact etc. was taken and cases were grouped into intermittent, mild persistent, moderate persistent and severe persistent bronchial asthma according to the global initiative for asthma (GINA) guidelines [2].
A detailed clinical examination was done to rule out other causes of wheezing. Investigations like CBC, eosinophil percentage, Mantoux test, spirometry, chest X ray, sputum or gastric aspirate for acid fast bacilli (AFB) were done. Subjects performed spirometry in sitting position. The parameter of forced expiratory volume in 1 second (FEV1) and forced vital capacity (FVC) were measured. A minimum of the three acceptable manoeuvres were performed with two highest values of both FEV1 and FVC was reproduced within 5%. The highest values of FVC and FEV1 were used for analysis.

Statistical analysis

The collected data was entered into Microsoft Excel Worksheet-2010 and data was taken into IBM SPSS statistic for windows, version 24(IBM Corp., Armonk, N.Y., USA) software for calculation of frequency, percentage, mean and standard deviation. T-test was used to compare the means of two groups.

Results

Table 1: Bio-social characteristics of the study population

Sr No.	Bio-social characteristics	No. of Patients	Percentage
	Sex		
1	Male	38	76
2	Female	12	24
	Total	100	100
	Allergic conditions		
1	Yes	50	50
2	No	50	50
	Total	100	100
	Allergy Severity		
1	Intermittent	34	68
2	Mild persistent	12	24
3	Moderate persistent	04	08
	Total	50	100
	FHBA (family history of bronchial asthma)		
1	Yes	31	31
2	No	69	69
	Total	100	100
	Patient's Built		
1	Mild	01	01
2	Moderate	99	99
	Total	100	100

It was observed from **Table 1** that among the 50 patients, 76% were males and 24% were females with a male to female ratio of 3:1. In the present study, the mean age of male was recorded to be about 6.67 and female 6.75. Age standard deviation of male was 2.64 and female was 2.67. Out of 100 patients, 50% of the patients were with an allergy and other 50 % were reported with no allergy. Of 50 patients were having bronchial asthma. Among them, 20 patients were not having family history of bronchial Asthma. In non-bronchial asthma group, only one member had family history of bronchial asthma and 49 members did not have any family history of bronchial asthma. Studies on allergy severity revealed that out of the 50 patients, 34 patients i.e. 68% of the total population were having intermittent severity, 12 patients i.e. 24% were having mild persistent severity and 4 patients i.e. 8% of the total population were having moderate persistent severity. Out of 100 patients, 31% of the patients were having FHBA and other 69% of the patients were reported of not having FHBA. With regard to build, out of 100 patients, 99% were moderately built and 1% with mild built.

Table 2: Comparison of Peripheral Eosinophil and Absolute Eosinophil Count between asthmatic and non asthmatic Patients

Sr No.			
Comparing Eosinophil Count in Control Group Vs Allergy Severity			
	Type of Patients	**Eosinophil% Mean ±SD**	**P-Value**
1	Non-Asthmatic	2.04 ± 1.58	P=0.001
2	Intermittent	4.63 ± 2.54	
3	Mild persistent	6.3 ± 5.16	
4	Moderate persistent	10.4 ± 6.84	
Comparing Actual Eosinophil Count in Control Group Vs Allergy Severity			
	Type of Patients	**Actual Eosinophil Count Mean ±SD**	
1	Non-Asthmatic	181.08 ± 134.74	P=0.001
2	Intermittent	458.09 ± 254.98	
3	Mild persistent	571.50 ± 384.92	
4	Moderate persistent	1047.50 ± 836.15	
Comparing Eosinophil Count in Intermittent Vs Mild Persistent Patients			
	Severity of Asthma	**Eosinophil% Mean ±SD**	
1	Intermittent	4.63 ± 2.54	P=0.1
2	Mild persistent	6.3 ± 5.16	
Comparing Eosinophil Count with Intermittent Vs Moderate Persistent Patients			
	Type of Patients	**Eosinophil% Mean ±SD**	
1	Intermittent	4.63 ± 2.54	P=0.001
2	Moderate persistent	10.4 ± 6.84	
Comparing Eosinophil Count with Mild Persistent Vs Moderate Persistent Patients			
	Type of Patients	**Eosinophil% Mean ±SD**	
1	Mild persistent	6.3 ± 5.16	P=0.1
2	Moderate persistent	10.4 ± 6.84	
Comparing Actual Eosinophil Count between Intermittent Vs Mild Persistent Patients			
	Type of Patients	**Actual Eosinophil Count Mean ±SD**	
1	Intermittent	458.09 ± 254.98	P=0.2
2	Mild persistent	571.50 ± 384.92	
Comparing Actual Eosinophil Count in Intermittent Vs Moderate Persistent Patients			
	Type of Patients	**Actual Eosinophil Count Mean ±SD**	
1	Intermittent	458.09 ± 254.98	P=0.002
2	Moderate persistent	1047.50 ± 836.15	
Comparing Actual Eosinophil Count with Mild Persistent Vs Moderate Persistent Patients			
	Type of Patients	**Actual Eosinophil Count Mean ±SD**	
1	Mild persistent	571.50 ± 384.92	P=0.1
2	Moderate persistent	1047.50 ± 836.15	

It was seen from **Table 2** that in asthmatic patients, eosinophil percentage was compared between intermittent patients and moderate persistent patients. Statistically (P=0.001); it indicates that there is a difference between intermittent and moderate persistent patient's eosinophil percentage. In asthmatic patients, eosinophil percentage was compared between mild persistent and moderate persistent patients. Statistically (P=0.1); it indicates no difference between mild persistent and moderate persistent patients. In asthmatic patients, actual eosinophil count was compared between intermittent and mild persistent patients. Statistically (P=0.2); it indicates that there is no difference in actual eosinophil count between intermittent and mild persistent patients. In asthmatic patients, actual eosinophil count was compared between intermittent and moderate persistent patients. Statistically (P=0.002); it indicates that there is a difference between intermittent and moderate persistent patient's actual eosinophil count. In asthmatic patients, actual eosinophil count was compared between mild persistent patients and moderate persistent patients. Statistically (P=0.1); it indicates no difference between mild persistent and moderate persistent patients.

In asthmatic patients, haemoglobin means ± SD was 11.34 ± 1.56 and patients without asthma, haemoglobin means ± SD was 11.69 ± 1.4. It shows that there is no difference between asthma and non-asthma patients; P=0.46. So, it indicated that haemoglobin may not be affected in asthma patients. In asthmatic patients, WBC means ± SD was 11030 ± 4968.8 and patients without asthma, WBC means ± SD was 8730 ± 2777.5. It shows that there is difference between asthma and non- asthma patients; P<0.0001. So, it indicated that WBC increased in asthma patients compared to non- asthma patients.In asthmatic patients, eosinophil means ± SD was 5.51 ± 2.63 and patients without asthma, eosinophil means ± SD was 2.04 ± 1.58. It shows that there is difference between eosinophil percentage in asthma and non-asthmatic patients; P<0.0001. So, it indicated that eosinophil percentage was high in asthma patients. In patients with asthma, AEC means ± SD was 520.76 ± 233.17 and patients without asthma, AEC means ± SD was 181.08 ± 83.74. It shows that there is difference in AEC between asthma and non-asthma patients; P<0.0001. AEC was high in asthma patients.

Discussion

Eosinophilic airway inflammation and airway remodelling leading to persistent airflow obstruction are characteristic features of asthma, but the link between them is unclear [7]. Although tissue eosinophils are associated with remodelling of the airway wall, it has not been established whether this is a causal association [8,9]. Controlling eosinophilic inflammation with inhaled corticosteroids reduces exacerbations,[10,11]. but has not yet been shown to prevent the development of fixed airflow obstruction. One reason for the uncertainty is that measurement of eosinophilic airway inflammation using induced sputum is unsuitable for routine clinical practice or large-scale epidemiological studies [12]. Peripheral blood eosinophil counts have emerged as a promising and easily measured marker of eosinophilic airway inflammation [13,14]. High blood eosinophils are associated with poor asthma control and risk of exacerbations [15,16]. In addition, blood eosinophil counts predict the response to inhaled

corticosteroids in patients with chronic obstructive pulmonary disease (COPD) [17,18] and the response toanti-interleukin-5 therapy in asthma [19]. Blood eosinophil counts have been associated with lower forced expiratory volume in 1 second (FEV1) values in participants with and without asthma, but not all studies have found this [11,15]. Blood eosinophils did not predict an enhanced decline in FEV1 in asthmatic adults, [13] but a greater decline in FEV1 was observed in COPD patients with high blood eosinophil counts who were not treated with inhaled corticosteroids [11]. We investigated associations between blood eosinophil counts and lung function in a population-based birth cohort of young adults. We hypothesized that eosinophilic inflammation would be associated with airflow obstruction and a decline in lung function among participants with asthma.

In present study, out of 100 patients, 50% of the patients are with an allergy and other 50% are reported with no allergy. Total 100 patients were enrolled into study among them 50 (50%) were asthma patients and 50 (50%) were non-asthma (control group). In 100 populations, 75% were males and 25% were females with a male to female ratio of 3:1. In asthma patients, 50 cases, 76% were males and 24% were females whose ratio between male and female is 3.1:1. It is indicated that males have more risk to develop the asthma than females. Same observation was found int other studies like Mohammad Amir et al.[20] study male to female ratio of 1.6:1 and another study conducted by Animesh Jain et al.[21] they also found that male to female ratio for prevalence was found to be 1.5:1. In another study conducted by Kumar et al.[22] they also found male to female ratio of 1.7:1. In all the above three studies, males have more risk to develop the asthma attacks, which was same thing that was observed in present study. In the present study, age means of male was recorded to be about 6.67± 2.64 and female 6.75±2.67. In both genders, same age patients were enrolled into study and a study conducted by Pal et al.[23] population age means 7.24 closely to present study.

Out of 100 patients, 31% of the patients were having FHBA and other 69% of the patients were reported of not having FHBA. In the present study group, 50 patients were having the asthma. Among them, 20 patients were not having family history of asthma. In non-asthma group, only one member has family history of asthma and 49 members did not have any family history of asthma. It has shown a significant P<0.0001; this indicates that family history is one of the major reasons for the asthma. This finding is in accordance with a study carried out by Animesh Jain et al.[21] Kumaret al.[22] and Qureshi UA et al.[24].

In patients with asthma, Eosinophil means ± SD was 5.51 ± 2.63 and patients without asthma, Eosinophil means ± SD was 2.04 ± 1.58. Statistically, it shows that there is difference between eosinophil percentage in asthma and non-asthma patients (P<0.0001). So, Eosinophil percentage is high in asthma patients. A study conducted by Bhalla K et al [25] in patients with asthma, 6.9% with high eosinophil counts and it was concluded that interaction between atopy and eosinophil level in asthma cases was very strong in children but absent in oldest adults, which suggest different mechanistic pathways for these factors by age and supports the notion that asthma is a heterogeneous disease.

Conclusions

There were 50 cases of asthmatic and 50 non-asthmatics as controls were studied. Asthmatics were classified into intermittent, mild persistent, moderate persistent and severe persistent as per GINA guidelines. In our study sample, none of the children presented with severe persistent asthma, excluding it from the study. Routine investigations, CBP, Hb%, WBC, eosinophil percentage and absolute eosinophil counts were measured in both asthmatic and non-asthmatic children. Absolute eosinophil count and eosinophil percentage were significantly higher in asthmatics than in non-asthmatic children. It can be concluded that blood eosinophil percentage and absolute eosinophil count can be considered as early indicators for asthma.

Limitations

One of the limitations was the spirometry is difficult to perform in children less than 5 years. It may not be ideal to rely on spirometry to diagnose asthma. Other causes of blood eosinophilia like parasite infections have not been excluded. Other parameters like serum IgE was not done in the study because of cost concern.

Recommendations

As the study has been undertaken in a limited sample, a large multicentric study should be conducted to procure precise results and apply it to the general population. A combined usage of other parameters like serum IgE, sputum, eosinophils and sputum IgE may increase the significance of study.

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