

Evaluation of some Haematological Parameters in Asthmatic Patients Attending Imo State University Teaching Hospital, Orlu, Imo State, Nigeria

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ABSTRACT

Background: Asthma is a condition in which a person's airways become inflamed, narrow, swell and produce extra mucus which makes breathing difficult. It is a public health problem in all countries regardless of the level of development. In asthmatic condition, levels of some haematological parameters are altered.

Aim and objectives: The aim of this study was to determine the levels of some haematological parameters in asthmatic patients attending Imo State University Teaching Hospital, Orlu. The objectives includes: To determine the levels of Haemoglobin (Hb), White Blood Cell (WBC), platelets and differential WBC counts among asthmatic patients and non-asthmatic subjects.

Methodology: A cross-sectional study was carried out at Imo State University Teaching Hospital, Orlu from August-October, 2019. Fifty (50) asthmatic patients constituted the study population, while an equivalent number of apparently healthy age-matched individuals served as the controls. Questionnaires were administered to obtain their social and demographic data. Two milliliters (2 mls) of blood was collected from each individual and dispensed into potassium Ethylene Diamine Tetraacetic Acid (EDTA) containers for investigation of hematological parameters using haematology autoanalyzer. Data generated were analyzed using SPSS version 21.

Results: The mean values of WBC ($\times 10^9/l$) (11.41 ± 1.77), neutrophils (%) (65.64 ± 7.97) and eosinophils (%) (5.76 ± 2.35) in the test groups were significantly raised when compared to the controls (4.88 ± 1.08), (57.28 ± 8.74) and (0.20 ± 0.50) respectively ($p < 0.001$). That of Hb (g/dl) (10.60 ± 0.66) and lymphocytes (%) ($27. \pm 6.39$) were significantly decreased in the study group compared to the control (11.85 ± 1.00) and (41.72 ± 7.72) ($P < 0.001$), while the platelets in the test group (241.96 ± 55.69) were non-significantly increased when compared to the control (215.49 ± 43.13) ($p = 0.066$). The level of monocytes in the study group (0.12 ± 0.44) showed no significant difference when compared to the control (0.016 ± 0.37) ($p = 0.731$).

Conclusion: The findings have shown that some haematological parameters are altered in asthmatic condition. Therefore, these parameters should be included in the diagnosis of asthma for proper management of asthmatic patients.

Keywords: Haematological parameters; Asthma; Orlu

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INTRODUCTION

Asthma is a common chronic disorder of the airways that is complex and characterized by variable and recurring symptoms, airflow obstruction, bronchial hyper responsiveness and an underlying inflammation. The interaction of these features of asthma determines the clinical manifestations and severity of asthma and the response to treatment [1]. It is triggered or stimulated by a variety of factors provided there is genetic predisposition to develop asthma [2].

The presence of underlying airway inflammation is central to the various phenotypic patterns of asthma, this airway inflammation, is variable and has distinct but overlapping patterns that reflect different aspects of the disease such as intermittent versus persistent or acute versus chronic manifestations [3]. Acute symptoms of asthma usually arise from Bronchospasm and require and respond to Bronchodilator therapy. Acute and chronic inflammation can affect not only the airway caliber and airflow, but also underlying bronchial hyper responsiveness, which enhances susceptibility to bronchospasm [3]. It is characterized by inflammation of the bronchial tubes with increased production of sticky secretions inside the tubes. Symptoms appear when the airways tighten, inflame or fill with mucus. Common symptoms include; coughing, spat night, wheezing, shortness of breath, chest tightness, pain, or pressure. Every person with asthma doesn't have the same symptoms in the same way. A person may not have all these symptoms or may have different symptoms of different times [4]. The symptoms may also vary from one asthma attack to the next, being mild during one, and severe during another. Some people with asthma may go for extended periods without having any symptoms, interrupted by periodic worsening of their symptoms called "Asthma Attacks". Others might have asthma symptoms every day. In addition, some people may only have asthma during exercise or asthma with viral infections like colds [5].

Mild asthma attacks are generally more common. Usually, the airways open up within a few minutes to a few hours. Severe attacks are less common but last longer and require immediate medical help. It is important to recognize and treat even mild asthma symptoms to help prevent severe episodes and keep asthma under better control [6].

Hematological parameters are measurable blood indices that can be used as markers in the diagnosis and monitoring of certain physiological and pathological abnormalities. This parameter can be affected by disease conditions affecting hematopoietic physiology and due to immunological response. For example, allergic hematological parameters such as eosinophils and neutrophils [7-9]. A significant increase in white blood cell count in asthmatic condition has been reported [9]. No significant difference on platelet count was observed among non-allergic asthmatic patients when compared with healthy groups [10]. Circulating eosinophils were elevated with low lymphocyte count in asthmatic patients [11]. An evidence for activation of alveolar macrophages, but not peripheral blood monocytes, among asthmatic patients has been reported.

MATERIALS AND METHODS

Study area

The study was carried out at federal medical centre, Owerri, Imo State, Nigeria. It is a government tertiary health care institution handling health issues relating to anesthesia, medical laboratory services, orthopedic/trauma and others. Owerri is the capital of Imo State, which is located in the South Eastern part of Nigeria. Owerri consists of three local government areas which include- Owerri municipal, Owerri North and Owerri West. It has an estimated population of about 401,873 as of 2006 census and is approximately 100 square kilometers in area [12]. Owerri is bordered by the Otamiri River, to the east and the Nworie River, to the south.

Study design

This was a cross-sectional study conducted from the month of September to November, 2021. All eligible subjects who filled the questionnaire and gave a written informed consent for the study were sampled. Fifty (50) patients confirmed to be suffering from asthmatic condition were enrolled for this study and served as the test group, while an equivalent number of age-matched apparently healthy subjects constituted the control group. Blood samples were collected and dispersed into an Ethylene Diamine Tetraacetic Acid (EDTA) container and mixed gently. Hematological parameters were determined using sysmex hematology autoanalyzer kx-21, by sysmex corporation, Japan. Data generated were analyzed using SPSS version 21, and the mean, standard deviation, t-test, correlation and p-values were determined.

Sample collection

Five (5 ml) of venous blood was collected using a sterile disposable syringe and dispensed into EDTA container. This was properly covered, gently mixed and the container labeled clearly with the participant's number. The blood sample was used for screening, to rule out other infections and for the estimation of hematological parameters.

Statistical analysis

All the data were entered and analyzed using SPSS version 21 software. The values were expressed as mean \pm standard deviation. Pearson's correlation was determined and the test of significance was determined by student t-test values. P values < 0.05 were considered as statistically significant.

RESULTS

Mean values of haematological parameter in asthmatic patients (test) vs. control

Table 1 shows that the mean values of Hb and Lymphocyte were significantly lowered in asthmatic patients (10.6 \pm 0.66) g/dl and (27.32 \pm 6.39)% respectively when compared to controls (11.85 \pm 1.00) g/dl and (41.72 \pm 7.72)% respectively p < 0.001 .

The mean values of WBC, neutrophils and eosinophils were significantly increased in asthmatic patients [(11.41+1.77) × 10⁹/L, (65.64+7.97)% and (5.76+2.35)] when compared to controls (4.88+1.08) × 10⁹/L, (57.28+8.74)% and (0.20+0.50) p<0.001.

There was no statistical significant difference in the mean values of platelet and monocytes in asthmatic patients [(241.96+55.69) × 10⁹/L and (0.12+0.44)% when compared to controls (215.41+43.13) × 10⁹/L and (0.16+0.37)% (P=0.066 and 0.731) (Table 1).

Haematological parameters	Test (n=50)	Control (n=50)	t-value	p-value
Hb(g/dl)	10.6+0.66	11.85+1.00	5.19	0.001*
WBC (× 10 ⁹ /L)	11.41+1.77	4.88+1.08	15.74	0.001*
Platelets (× 10 ⁹ /L)	241.96+55.69	215.41+43.13	1.88	0.066
Neutrophils(%)	65.64+7.97	57.28+8.74	1.53	0.001*
Lymphocytes (%)	27.32+6.39	41.72+7.72	7.18	0.001*
Eosinophils (%)	5.76+2.35	0.20+0.50	11.57	0.001*
Monocytes (%)	0.12+0.44	0.16+0.37	0.35	0.731

Note: Hb: Haemoglobin, WBC: White Blood Cell, *: Significant at p<0.05 level

Table 1: Mean Values of Haematological Parameters in Asthmatic Patients (Test) vs. Control.

Correlation of TWBC with differential white cell counts in asthmatic patients

There was a non-significant positive correlation of Total White Blood Cells (TWBC) with neutrophils, lymphocytes and monocytes (r=0.188, p=0.369, r=0.096, p=0.650, and r=0.234, p=0.259) respectively and a significant correlation of TWBC with eosinophils (r=0.493, p=0.012) (Table 2).

Dependent variable	n	r	P-value
Neutrophil	50	0.188	0.369
Lymphocyte	50	0.096	0.65
Eosinophil	50	0.493	0.012*
Monocytes	50	0.234	0.259

Note: N-Neutrophils, L-Lymphocytes, E-Eosinophils, M-Monocytes, *-Significant at p<0.05 level

Table 2: Correlation of TWBC with differential white cell counts in asthmatic patients.

Correlation of TWBC with haemoglobin and platelet in asthmatic patients

There was a non-significant positive correlation of TWBC with hemoglobin and platelet (r=0.107, p=0.652 and r=-0.086, p=0.719) (Table 3).

Dependent variable	n	r	p-value
Haemoglobin	50	0.188	0.369
Platelet	50	0.096	650

Table 3: Correlation of TWBC with hemoglobin and platelet in asthmatic patients.

DISCUSSION

Asthma is a major non-communicable disease caused by inflammation and narrowing of the small airways in the lungs. Symptoms can be any combination of cough, wheeze, shortness of breath and chest tightness. Asthma affected an estimated 262 million people in 2019 and caused 461000 deaths [13].

The present study revealed that the mean value of Hb was significantly lowered in asthmatic patients when compared to

controls. This disagrees with the study which reported an increase in Packed Cell Volume (PCV), due to hypoxic conditions which provoke synthesis of more Hb, hence an increase in haemoglobin level in asthmatic patients. The decrease in Hb concentration in asthmatic patients in this study might be due to the fact that asthma affects erythropoietin production. Erythropoietin is the principal stimulator of erythropoietin and is induced under hypoxic conditions. Certain

factors such as treatment regimen, sample size an environmental factor might be a factor causing the disparity in results [14].

The WBC count was significantly increased in asthmatic patients compared to the control group. This is in agreement with the work done by [15] who also reported an increase in WBC

count. The increase in WBC might be due to increases in eosinophils and neutrophils counts [16]. It has shown that the increased number of eosinophils in peripheral blood and in bronchial lavage from subjects with Asthma is associated with more severe disease. Similarly, neutrophils are more prominent in airway secretions during acute severe asthma exacerbations, where they play roles in both the initiation and resolution of attacks [17].

In this study, the mean value of platelet count was insignificantly higher in asthmatic patients when compared to the control group. Other studies reported significant increase in platelet count in allergic asthmatic patients who were hospitalized and ambulatory patients [18]. Previous studies also reported no significant difference in platelet count among non-allergic asthmatic patients compared to healthy groups [19]. The difference in platelet count in this study might be because both allergic and non-allergic asthmatic patient were considered as the study groups.

The eosinophils and neutrophils were significantly raised in asthmatic patients compared to the control group. The increase in eosinophils is consistent with the study of [20] who stated that eosinophils were elevated in asthmatic patients. This increase might be due to the fact that circulating eosinophils are elevated in patients with allergic conditions. It has been reported that eosinophils recruitment is being induced by exotoxin and the involvement of *IL-4* and *IL-13* is allergic reactions [21] also, the increased number of eosinophils in peripheral blood and in bronchial lavage in asthmatic patients is associated with more severe disease.

The neutrophils are increased in asthmatic condition, maybe because they are more prominent in airways secretions during acute severe asthmatic attack, where they play roles in both the imitation and resolution of attacks [22].

This study showed low level of monocytes in asthmatic patients which was insignificant compared to controls. This agrees with the study done by [23] who showed evidence for the activation of alveolar macrophages, but not peripheral blood monocytes, among asthmatic patients. This might be due to monocytes migration from the bone marrow to the inflamed tissue though the peripheral blood system and mature into macrophages.

There was a non-significant positive correlation of TWBC with neutrophils, lymphocytes, monocytes, haemoglobin and platelets, while a significant positive correlation of TWBC with eosinophils was observed. This might be due to the fact that eosinophils which are white blood cells are raised in asthmatic patients and in allergic conditions. Neutrophils, which are also increased in asthmatic are the major white blood cells [24,25].

CONCLUSION

This study has shown that haematological parameters are altered in asthmatic condition. Haematological parameters that showed significant changes such as Hb, PCV, TWBC count and eosinophils should be considered, and used as markers of asthma, for proper management and monitoring of asthmatic

patients. Further studies should work on naïve asthmatic and asthmatic patients on treatment, and also, on longitudinal studies.

ETHICAL APPROVAL

The ethical approval was obtained from the chairman of health research ethics committee of federal medical centre, Owerri, Imo State, Nigeria.

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