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Association of Erythrocytes Sedimentation Rate and Platelets Indices in Diabetes in the Elderly

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Abstract

Recent research indicates that inflammation can contribute to the etiology of diabetes which is characterized by hyperglycemia and abnormalities in insulin secretion and/or activity. Erythrocyte sedimentation rate (ESR) is the most often utilized laboratory test for detecting systemic inflammation among all plasma inflammatory indicators. Patients with diabetes have reportedly shown altered platelets, due to "prothrombotic condition" with increased platelet reactivity leading to vascular problems. The objective of the study was to relate platelet indices and erythrocyte sedimentation rates with Diabetes. The morphology, metabolism, and function of erythrocytes are invariably subject to a number of alterations when there is persistent hyperglycemia. Few prospective studies have looked at this issue, hence, the investigation of the link between Erythrocytes Sedimentation Rate and Platelets indices in Diabetes in a private hospital in Port Harcourt (Port Harcourt, the capital of Rivers State is the major city, situated by the Bonny River in Southern Nigeria), The study had 100 subjects who gave their consent and were chosen from among others for this cross-sectional study. Fifty patients were confirmed diabetes (21 men and 29 women; mean age: 60.1±5.02 years) and 50 control subjects without diabetes (20 men and 30 women; mean age: 58.08±5.67 years). Aseptic blood collection techniques were used to obtain blood samples from the diabetic and control groups into EDTA vials. The Sysmex XE-2100 Haematology Automated Analyzer was used to estimate platelet indices, and the Western green method was used to calculate ESR. Using the Excel Data Analysis Tool pack, the estimated values of the parameters were statistically evaluated. Both the control and diabetes groups, displayed a statistically significant difference in the mean values of ESR hence the level in the diabetic group showed greater mean values when compared to the control group values 37.42±20.55 mm/hr and 29.78±13.26 mm/hr respectively at (P=0.029). Comparing the means of the platelet indices between the two groups at a significance level of (P=0.674), there was no discernible change. The clinical diagnostic utility of ESR as a helpful indicator for following diabetic patients' progress strongly correlates with the frequency and

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intensity of inflammation in diabetes. It was concluded that inflammation plays a role in the development of diabetes is constantly supported by this study.

Keywords: Association, Erythrocytes Sedimentation Rate, Platelets, Indices, Diabetes.

1. Introduction

A series of metabolic illnesses known as diabetes mellitus (DM) are characterized by hyperglycemia and abnormalities in insulin secretion and/or activity (American Diabetes Association, 2013). According to the World Health Organization (WHO), diabetes mellitus (DM) is a metabolic illness with numerous etiologies that is defined by persistent hyperglycemia and changes in protein, carbohydrate, and lipid metabolism as a result of problems with insulin secretion or action (Alberti and Zimmet, 2015).

Diabetes risk factors include heredity, obesity, inactivity, poor diet, stress, urbanization, impaired glucose tolerance, and hypertension (American Diabetes Association, 2013). Practically 171 million people worldwide today have diabetes mellitus, and 366 million are expected to have it by 2030. 5.77% of Nigerians had diabetes in 2017, (Uloko *et al.*, 2018). When compared to earlier research, investigations revealed Rivers State as having an estimation of 42.7% rise in diabetes. (Cookey *et al*., 2022).

ESR stands for the blood's erythrocytes' rate of sedimentation. In healthy individuals, it swings within a small range, but it rises in many pathological diseases. (Lee *et al*., 2019). Erythrocyte sedimentation rate (ESR) is the most frequently used laboratory test for determining systemic inflammation among all plasma inflammatory indicators (Mirsaeidi *et al*., 2016). According to Guo *et al*. (2020) ESR can be utilized as a marker to assess the development of diabetic patients.

Red blood cells (RBCs), otherwise known as erythrocytes, are good consumers of glucose. In the presence of long-lasting hyperglycemia, the morphology, metabolism, and function of erythrocytes are inevitably exposed to a series of alterations. (Zhou *et al*., 2018; Sprague *et al*., 2006).

The most recent hematological analyzers include a multitude of platelet characteristics that make it simple to see changes in platelet shape and could aid in the early identification of platelet prothrombosis. They may serve as warning signs for identifying the beginning or progression of diabetic problems (Archana *et al*., 2017). Mean platelet volume (MPV), platelet distribution width (PDW), and platelet large cell ratio are three platelet indicators (P-LCR). PDW is a measure of platelet heterogeneity, which may be caused by aging of platelets or heterogeneous demarcation of megakaryocytes, and P-LCR is a measure of larger platelets. Mean platelet volume, which is one of the platelet indices, reflects changes in either platelet stimulation or the rate of platelet production (Schneider, 2009).

Changes in the body's internal environment cause a steady increase in the number of deformed erythrocytes while simultaneously decreasing the number of normal, biconcave disc erythrocytes, which raises the risk of diabetes complications. A better comprehension of the

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development of diabetes can be attained by analysing changes in the morphology and structure of erythrocytes in diabetics (Gyawali *et al*., 2014).

2. Materials and Methods

2.1 Study Design

This is across-sectional study carried out among patients accessing care in a private hospital.

2.2 Study Area

This facility-based study was carried out at a private hospital in Port Harcourt, the state capital of Rivers State. Port Harcourt is a city in Nigeria's South-South geopolitical zone, also known as the Niger Delta, with a population of 1,865,000, located along the Bonny River.

2.3 Study Population

A total of 100 participants comprising male and female who were 50 years of age or older were used in this investigation. 50 of the test volunteers were used as controls and did not have diabetes mellitus, whereas the other 50 were diabetic patients.

2.4 Blood Sample Collection, Storage, and Transportation

With the aid of a vacutainer tube and needle, blood samples were drawn from the veins and placed in labeled EDTA anti-coagulated bottles following Chesbrough's description. (Cheesbrough, 2010)**.** These specimens were immediately transferred to the laboratory using a triple packaging system and kept at 4℃ prior to testing.

3. Methodology

Determination of Erythrocytes Sedimentation Rate

Method: Westergreen

The test participants' venous blood was drawn and placed in EDTA bottles with labels. 1 volume of anticoagulated diluents and 4 volumes of blood were combined. The standard Westergren tube was then filled with the diluted blood until it reached the 0 mark, and the tube was essentially left on the stand motionless and vibration-free for 1 hour. The tube's flow rate was then measured in mm/hr. The test was performed two hours after blood was drawn.

Measurement of Platelets Indices

Method: Automation using Sysmex XE-2100 Haematology Automated Analyser.

Before beginning platelet counting, blood samples were maintained at 25^{o}C room temperature in 4mL vials containing Tri potassium ethylene diamine tetra-acetic acid (K3EDTA). The samples were examined 24 hours after being collected. After carefully mixing the blood with a mixer, the blood samples were put into the analyzer. Using a Sysmex XE-2100 as directed by the manufacturer, platelets were measured. To measure platelets, the Sysmex XE-2100 uses fluorescent flow cytometry with a semiconductor diode laser. Oxazine fluorescent dyes enter the platelets and stain the RNA. The forward scatter light (volume) and fluorescence intensity (mRNA content) are assessed after the stained platelets are exposed to a semiconductor diode

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laser beam. On the basis of the intensity of their fluorescence, the mature and immature platelets are distinguished.

3.1 Statistical Analysis

The information (estimated values) from the platelet indices and ESR laboratory analysis were recorded, categorized, and structured on an excel sheet. Descriptive analysis (Means and Standard deviations (SD)) was carried out using the Excel data analysis toolkit, and the data was reported as Means±SD. At a significance threshold of 0.05, the T-test was employed to compare the significant difference between the means of the two groups. The relationship between the diabetes ESR and the diabetic platelet indices was examined using regression analysis.

4 Results

4.1 The Control and Diabetic Groups' Representations in Terms of Demographics

The number of subjects with diabetes and controls is shown in Table 4.1. In this study, 50 diabetes and 50 control participants were utilized. The control group was made up of 20 men and 30 women, while the diabetic case subjects were made up of 21 men and 29 women with the disease. The participants' ages ranged from 50 to 68 on average**.**

4.1 Demographic Representation of the Control and Diabetic Group

Groups	Gender	N (%)	Age Range (Years)	Average Age (Years)	T-crit	T-stat
Control (n=50)	Male	n = 20(40%)	50-69	57.6	1.676	-1.986
	Female	n =30(60%)	50 – 67	58.4		
	Combined	n= 50(100%)	50-69	58.08		
Diabetic (n=50)	Male	n = 21(42%)	50 – 68	58.76		
	Female	n= 29(58%)	54 – 68	61.06		
	Combined	n= 50(100%)	50- 68	60.1		

T-cri t > T-stat: there is no significant difference of the mean age between the diabetic group and control group.

4.2 ESR and Platelet indices Mean± SD Values of Control and Diabetic Group

The mean SD values for the ESR and platelet indices in the control (non-diabetic) and diabetic participants are displayed in Table 4.2.

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Table 4.2: ESR and Platelet indices Mean± SD Values of Control and Diabetic Group

Parameter	Control Mean± SD	Diabetic Mean± SD	t-value	Mean Significant Difference
ESR (mm/hr)	29.78±13.26	37.42±20.55	0.029	Significant
PLT (10^3/µL)	241.24±74.36	248.04±86.84	0.674	Not Significant
MPV (FL)	11.56±0.76	12.12±4.26	O.363	Not Significant
PDW (FL)	17.09±2.44	16.52±2.03	0.209	Not Significant
PCT (%)	0.27±0.08	0.49±1.31	0.246	Not Significant
P-LCR (%)	43.91±7.71	43.61±10.77	0.875	Not Significant

4.3: Correlation of ESR and Platelets Indices with Diabetes

The relationship (association) between the ESR and platelets indices in diabetes people is displayed in Table 4.3. At a significance level of 0.05, there was no statistically significant correlation between the ESR and the platelet indices in the diabetic participants.

Table 4.3: Correlation of ESR and Platelets Indices with Diabetes

Pearson Correlation	R- Value	P-Value	Comment
PLT versus **ESR**	0.010	0.942	No Significant Association
MPV versus **ESR**	0.014	0.918	No Significant Association
PDW versus **ESR**	0.027	0.849	No Significant Association
PCT versus **ESR**	0.055	0.699	No Significant Association
P-LCR versus **ESR**	0.022	0.874	No Significant Association

Discussion

Revelations made from the study show that ESR levels were greater in the diabetes group than in the non-diabetic group, measuring 37.42±20.20 and 29.78±13.26 at ($p<0.029$) respectively. The higher ESR levels seen in diabetes patients in this study are consistent with findings of Pal *et al*. (2017), who found comparable results in their studies. The ESR outcome of this study, however, differs from that of others, such as Heo *et al.* (2012), who found that diabetic individuals with myocardial infarction did not have an elevated ESR, with a p-value of ($p<0.20$).

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Increasing evidence highlights how crucial inflammation is to the emergence of diabetes. Macrophages accumulate in the kidney during the early stages of diabetes and produce chemokines, pro-inflammatory cytokines, and cell adhesion molecules that attract more macrophages to the kidney and exacerbate inflammatory injury.

RBCs often have negative external charges that cause them to reject one another. Many plasma proteins can successfully balance the negative surface charges of the RBCs, resulting in the formation of the rouleaux. An increase in plasma proteins (found in inflammatory conditions) will produce an increase in rouleaux formations because they settle more quickly than individual red blood cells do (Hashemi *et al*., 2015). The rouleaux aggregates settle at a constant rate in the Westergren tube. By generating rouleaux, which increases the ESR, the RBCs can settle more quickly (Taneja, 1997).

Also, no statistically significant difference was seen between the control and diabetes groups in any of the platelet indices, according to this study i.e., PLT (248.04±86.84 and 241.24±74.36) at $p<0.674$, MPV (12.12±4.26 and 11.56±0.76) at $p<0.363$, PDW (16.52±2.03 and 17.09±2.44) at $p<0.209$, PCT (0.49±1.31 and 0.27±0.08) at 0.246, P-LCR (43.61±10.77 and 43.91±7.71) at $p<0.875$ respectively. The findings of this study contrast with those of other researchers, such as Kumari and Potekar (2018), who found that diabetics had considerably greater MPV, PDW, and P-LCR levels than non-diabetics did in their study at (11.3 ± 1.0 vs. 9.0 ± 0.6, 14.2 ± 2.5 vs. 10.7 ± 0.7 fl, 35.0 ± 8.1 vs. 23.0 ± 2.4%) respectively. In addition, (Levent *et al*., 2015) found that the majority of platelet indices, including platelet count, PCT, MPV, and PDW, were considerably greater in diabetic patients than the control (non-diabetic) group at a P value of ($p<0.05$). This however, is different from the research work of Archana *et al*. 2017 who found that the Diabetics had a considerably lower platelet count (P = 0.005) (Archana *et al*., 2017).

It is unclear what causes platelet indices to have non-significant values. Platelet indices levels may be influenced by a number of variables, such as genetic variants, type of treatment used, lifestyle choices (diet, drinking, smoking, and physical activity), pre-and post-analytical techniques, hormone profiles, age, gender, and race/ethnicity.

Conclusion

The clinical diagnostic utility of ESR as a helpful indicator for following diabetic patients' progress strongly correlates with the frequency and intensity of inflammation in diabetes. The conclusion that inflammation plays a role in the development of diabetes is constantly supported by this study.

Consent and Ethical Approval

Patients who looked to be in excellent health prior to enrolment gave their informed permission after the Department of Medical Laboratory Science at Rivers State University, Port Harcourt, gave its clearance.

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