



## Evaluation of Haematological Parameters in Stroke Patients in South-Western Nigeria

I. Akinlua<sup>1\*</sup> and M. F. Asaolu<sup>1</sup>

<sup>1</sup>Department of Biochemistry, Ekiti State University, Ado Ekiti, Nigeria.

### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author IA designs the work, did the statistical analysis and prepare the first draft of the manuscript. Author MFA prepare the final draft of the manuscript. Both authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/AJRB/2019/v5i330093

#### Editor(s):

- (1) Dr. Fabio Altieri, Professor, Department of Biochemical Sciences, Faculty of Pharmacy and Medicine, Sapienza University, Rome.
- (2) Dr. Mohamed Fawzy Ramadan Hassanien, Professor, Biochemistry Department, Faculty of Agriculture, Zagazig University, Zagazig, Egypt.
- (3) Dr. Héctor Manuel Mora Montes, Departamento de Biología, División de Ciencias Naturales y Exactas, Universidad de Guanajuato, Guanajuato, México.
- (4) Dr. Mohamed Atiega Elbagermi, Associate Professor, Analytical Chemistry, Department of Chemistry, Misurata University, Libya.

#### Reviewers:

- (1) Heba Gamal Abd El-Aziz Nasr, Al-Azhar University, Egypt
- (2) Ramachandran Muthiah, Thoothukudi Medical College Hospital, India.
- (3) Franco Cervellati, University of Ferrara, Italy.

Complete Peer review History: <https://sdiarticle4.com/review-history/51538>

**Original Research Article**

**Received 01 August 2019**  
**Accepted 02 October 2019**  
**Published 26 October 2019**

### **ABSTRACT**

**Introduction:** Stroke is a leading cause of morbidity and mortality worldwide. Atherosclerosis is a leading cause of both ischemic and haemorrhagic stroke which has been linked to chronic and acute inflammation. Variations in the biochemical status of stroke patients might be accountable for the high morbidity and mortality associated with stroke.

**Aims of the Study:** This study was designed to investigate haematological parameters namely Parked cell volume(PCV), Total Leucocyte Count(WBC), Platelet Count, and Differential Leucocyte Count(Neutrophil and Erythrocyte) in stroke patients attending various teaching and general hospitals in South-Western part of Nigeria.

**Place and Duration of the Study:** This study included already diagnosed stroke patients attending Teaching Hospitals and general hospitals in south-Western Nigeria and was carried out between 2015 to 2017.

\*Corresponding author: E-mail: [ibikunle.akinlua@eksu.edu.ng](mailto:ibikunle.akinlua@eksu.edu.ng);

**Methodology:** Packed Cell Volume (PCV), total leucocyte (WBC), differential leucocyte and platelet count was determined using the method of Cheesbrough, (1999).

**Results:** The result of this study revealed a significant increase  $p < 0.05$  in platelet count in stroke patients when compared with the control. Similarly, there is a significant increase  $p < 0.05$  in differential leucocyte count (neutrophil and lymphocyte count) in these patients when compared with the control. However, the WBC level in these patients is not significantly  $p < 0.05$  different from the control subjects. The PCV in stroke patients is significantly lowered  $p < 0.05$  when compared with the control subjects.

**Conclusion:** This study reveals alterations in most of the haematological parameters considered in this patients which is a pointer to the fact that these parameters with further investigations could give clues to the diagnosis and management of stroke thereby reducing its morbidity and mortality.

*Keywords: Park cell volume; total leucocyte count; differential leucocyte count; platelet count; stroke.*

## 1. INTRODUCTION

Stroke is a common neurological disorder and remain a leading cause of morbidity and acquired adult disability worldwide with a large socio-economic impact on the family of victims and the nation at large. [1] Stroke consists of two types, ischemic stroke (IS) and haemorrhagic stroke. ischemic stroke is caused by in situ cerebral thromboses or embolism to the cerebral vessels from a carotid or cardiac source, a process which might involve the action of platelets. Haemorrhagic stroke which accounts for about 20% of all stroke arises as a result of bleeding within the brain parenchyma or intraventricular spaces which can either be due to intracranial haemorrhage or intracerebral haemorrhage. Stroke that begins without haemorrhage (a thrombotic or embolic stroke) can lead to intracerebral haemorrhage shortly afterwards. This is especially common for embolic strokes that are related to a heart valve infection (endocarditis). In this case, a clump of bacteria and inflammatory cells from the valve infection can become a floating mass within the bloodstream (called an embolus). The infected clump can travel into a brain artery and become wedged there. Risk factors for hemorrhagic stroke are high blood pressure (hypertension), heavy alcohol use, advanced age and the use of cocaine or amphetamines [2].

Neutrophils help the body to fight infections and heal injuries. It may increase in the blood in response to several conditions or disorders which includes, injury, inflammatory disorders and some drugs, such as corticosteroids. [3] Neutrophils play key roles in ischemic brain injury, thrombosis, and atherosclerosis which could make it of great interest in the prevention and treatment of ischemic stroke.

Lymphocytes together with neutrophils are the major components of the differential leucocyte count (WBC) which in conjunction with the other white cell count give information about the immune system. Lymphocytes mediate antigen-nonspecific inflammatory response which could be as a result of injury or infections [4].

Platelets are specialized disk-shaped cells in the bloodstream that are involved in the formation of blood clots that play an important role in heart attacks, strokes, and peripheral vascular disease. In most people, the more than 200 million platelets in a millilitre of blood act as tiny building blocks to form the basis of a clot to stop bleeding from cuts or injuries. Platelets can detect a disruption in the lining of a blood vessel and react to build a wall to stop bleeding. [5] The packed cell volume (PCV) or the hematocrit is the volume in percentage (%) of red blood cells in the blood which is considered an integral part of a complete blood count results, along with haemoglobin concentration, white blood cell count, and platelet count. Because the purpose of red blood cells is to transfer oxygen from the lungs to body tissues, a blood sample's hematocrit can be used as a point of reference of its ability to deliver oxygen to body tissues. Anaemia refers to an abnormally low hematocrit, as opposed to polycythemia, which refers to an abnormally high hematocrit. [6] PCV estimations are essential risk factors that have been traceable to the aetiology of cardiovascular diseases especially hypertension [7].

## 2. MATERIALS AND METHODS

This study included 60 already diagnosed stroke patients attending Teaching Hospitals and

general hospitals in south-Western Nigeria and the same number of normal healthy subjects, without any known disease. Blood pressure was taken on the left arm after 5 minutes' relaxation, in a sitting position, using a standard mercury sphygmomanometer with appropriate cuff size; systolic (SBP) and diastolic (DBP) blood pressures corresponded to Korotkoff sounds 1 and V, respectively. The average of three readings, taken at first visit, was used for further analysis. Height and body weight were measured with participants standing without shoes and heavy outer garments. Blood was collected from the antecubital vein. Packed Cell Volume (PCV), total leucocyte (WBC), differential leucocyte and platelet count was determined using the method of Bain, (1995) [8]. The data collected were analyzed using one –way Analysis of variance (ANOVA) and Duncan multiple range tests to compare the data obtained from the text to those of the control. [9] All patients gave their informed consents.

### 3. RESULTS

The result of this study revealed a significant increase ( $p < 0.05$ ) in platelet count in stroke patients in compared with the control. A significant increase ( $p < 0.05$ ) in differential leucocyte count in these patients in compared to control was also recorded. However, the WBC level is not significantly different from the control.

### 4. DISCUSSION

A stroke is a form of cardiovascular disease affecting the blood supply to the brain, which is caused either by a blockage or a rupture in the vessel supplying blood to the brain. The results of the study expressed in Table 1 shows that these patients are older, obese with high blood pressure when compared with the control subjects. Old age, elevated blood pressure and obesity have been reported in patients with stroke. [10, 11] The results of haematological parameters of stroke patients and control subjects as shown in Table 2 revealed low pack cell volume (PCV) level in stroke, patients when compared with the control subjects. PCV is one of the most important determinants of whole blood viscosity and increased blood viscosity has been reported to contribute immensely to blood pressure increase which is a major risk factor for most cardiovascular diseases [7].

The differential leucocyte count (lymphocyte and neutrophil level) was significantly raised in these patients when compared with the control subjects. The elevated level of lymphocytes and neutrophils in stroke patients as revealed in this study may be due to atherosclerosis an inflammatory process and a major cause of cerebral infarction. This agrees with the outcome of an earlier study by . Lee *et al.* [12], and Zia *et al.* [13].

**Table 1. Parameters showing the anthropometric measurement of stroke patients and control subjects**

Parameters	Control	Stroke patients
Age(YRS)	24.50±1.63 <sup>b</sup>	61.0±13.28 <sup>a</sup>
Weight(KG)	53.66±22.6 <sup>b</sup>	83.5±17.52 <sup>a</sup>
Height(M)	1.48±0.2 <sup>a</sup>	1.62±0.20 <sup>a</sup>
B/P(mm/HG)	116.6/68.6 <sup>b</sup>	193.4/105.3 <sup>a</sup>
BMI(KG/M <sup>2</sup> )	24.5 <sup>b</sup>	31.6 <sup>a</sup>

Results are presented as means ± standard deviation. Values with different superscript are significantly different. B.P(Blood pressure), BMI(Body mass index)

**Table 2. Showing the level of haematological parameters of stroke patients and control subjects**

Parameter	Control	Stroke patients
PCV (%)	38.10±5.22 <sup>b</sup>	34.74±6.13 <sup>a</sup>
WBC(/L)	5.98±2.17×10 <sup>9a</sup>	5.74±3.28×10 <sup>9a</sup>
Lymph. (%)	47.38±10.13 <sup>b</sup>	57.24±10.49 <sup>a</sup>
Nutr. (%)	52.42±10.05 <sup>b</sup>	91.78±41.62 <sup>a</sup>
PLT(/L)	201.2±20.42×10 <sup>9b</sup>	269.3±57.53×10 <sup>9a</sup>

Results are presented as means ± standard deviation. Values with different superscript are significantly different. (PCV=packed cell volume, WBC=total leucocyte count, Lymph=lymphocyte, Neutr=neutrophil, PLT=platelet)

The result of the platelet count revealed a significant increase ( $p < 0.05$ ) in the platelet count of these patients when compared with the control subjects. Platelet counts measure the number of platelets in the blood. Platelets help the blood to clot at the site of a wound. Platelets have been concerned in the development and progression of atherosclerosis and its complications such as acute myocardial infarction, unstable angina and ischemic stroke. [14] The significantly ( $p < 0.05$ ) raised level of platelet count stroke could be due to atherosclerosis. A similar observation has been reported by [15,16] O Malley *et al.*, (1995) and Salim *et al.*, (2013).

## 5. CONCLUSION

This study reveals a significant response by the immune system of these patients as shown by the elevated level of differential leucocyte count. It also reveals a raised level of platelet counts in these patients which are factors if well monitored could be helpful both in early diagnosis and clinical management of the disease.

## CONSENT

As per international standard, patient's written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. World Health Organization. The top 10 causes of death ; 2017. [Cited 13/03/17]; Factsheet]
2. O'Donnell MJ, Xavier D, Liu L. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): A case-control study. *Lancet*. 2010;376(9735):112–123.
3. Merck, Neutrophils helps the body fight infections and heal injuries. *Functions of neutrophils*. 2015;3:(5)201–266.
4. Inohara M, Chamaillard M, McDonald C, Nunez G. NOD-LRR proteins: Role in host-microbial interactions and inflammatory disease. *Annu Rev Biochem*. 2005;74: 355–383.
5. Wu KK. Platelet activation mechanisms and markers in arterial thrombosis. *Journal of Internal Medicine*. 1996;239:17–34.
6. Purves WK, Sadava D, Orians GH, Heller HC. *Life: The Science of Biology*. Sunderland, Mass: Sinauer Associates. 2004;7:954.
7. Strand A, Gudmundsdottir H, Høiegggen, A, Fossum E, Bjørnerheim R, Os I, Kjeldsen SE. *Journal of the American Society of Hypertension*. 2007;1(6):400–406.
8. Bain BJ. *Basic haematological techniques in Practical Haematology 8<sup>th</sup> edition*. Edited by: Dacie JV, Lewis SM. Churchill Livingstone Inc, New York. 1995;49–82.
9. Zar JH. *Biostatistical Analysis*, Prentice-Hall, Inc., USA. 1984;620.
10. Finegold JA, Asaria P, Francis DP "Mortality from ischaemic heart disease by country, region, and age: Statistics from World Health Organisation and United Nations.". *International Journal of Cardiology*. 2012;168 (2):934–945.
11. Iloh GP, Ikwudinma AO, Obiegbu NP. Obesity and its cardio-metabolic comorbidities among adult Nigerians in a primary care clinic of a tertiary hospital in South-Eastern Nigeria. *Journal of Family Medicine and Primary Care*. 2013;2:20–26.
12. Lee CD, Folsom AR, Nieto FJ, Chambless LE, Shahar E, Wolfe DA. White blood cell count and incidence of coronary heart disease and ischemic stroke and mortality from cardiovascular disease in African-American and White men and women: Atherosclerosis risk in communities study. *American Journal of Epidemiology*. 2001; 154:758–64.
13. Zia E, Melander O, Bjorkbacka H, Hedblad B, Engstrom G. Total and differential leucocyte count in relation to incidence of stroke subtypes and mortality: A prospective cohort study. *Journal of Internal Medicine*. 2012;272: 298–304.
14. Boos CJ, Lip GY. Platelet activation and cardiovascular Outcomes in acute coronary syndromes, *Journal of*

- Thrombosis and Haemostasis. 2006; 4:2542–2543.
15. O'Malley T, Langhorne P, Elton RA, Stewart C. Platelet size instroke patients. Stroke. 1995;26:995–99.
16. Salim RH, Saad HA, Fatma AO. Evaluation of Platelet Indices in Patients with Acute Coronary Syndrome. Mustansiriya Medical Journal. 2013; 12:1.

---

© 2019 Akinlua and Asaolu; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*  
*The peer review history for this paper can be accessed here:*  
<https://sdiarticle4.com/review-history/51538>