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Altered Leucocyte Function and Hematological Parameters among Leukaemia Patients at the Oncology Department, National Hospital, Abuja

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Abstract **Original Research Article**

Background: The incidence of Leukaemia is increasing in developing countries, particularly in Africa. Cancer-associated inflammation is a significant factor in improvements and survival of people with cancers. This study was aimed at evaluating changes in leucocyte functions and hematological parameters among leukaemia patients in Abuja, Nigeria. ***Method:*** The study comprised 30 leukaemia patients attending the Oncology Department of National Hospital Abuja, Nigeria from July 2019 to August 2020 and 20 healthy people. Three millimetres (3m1) of blood was collected from each participant into EDTA bottle and analyzed for full blood and differential counts using the Mythic 22 (Orphne, Switzerland) five-part differential hematology analyzer. CD4 and CD8 T cells were analyzed out by flow cytometry. Data analysis was done using IBM-SPSS Inc., Chicago, IL, USA version-25.0. T-test was used to compare means of between groups and the significant value was set as $P<0.05$. ***Result:*** All hematological parameters were significantly lower ($P<0.05$) in leukaemia patients as compared to control except for monocytes and basophils. Also, WBC was significantly higher in leukaemia patients (13.0 ±0.57x109/L) as compared to 6.11±1.14109/L in control ($P<0.05$). CD4 (775.4082.91Cell/u1) and CD8 counts (634.40±101.43Cell/u1) were significantly higher in control as compared to leukaemia patients. Also, CD4/CD8 ratio was significantly higher ($P<0.05$) among control group 1.24 ± 0.15 than leukaemia patients (1.17 ± 0.09). ***Conclusion:*** This study found that changes in hematological parameters and leucocyte functions are significantly associated with leukaemia. The use of therapies that boost immune response in patients with leukemia is recommended.

Keywords: Leukemia, Cytometry, CD_4, CD_8, Hematology, Control, EDTA, Blood.

INTRODUCTION

The incidence of Leukaemia is increasing in developing countries, particularly in Africa. A group of cancers that originate from the bone marrow are generally called Leukaemia. It develops in the production of blood cells that have suffered a malignant transition which leads to numerous malfunctioning cells that are unregulated [1]. Leukaemia is "neoplastic clonal disorder of haemopoietic or neoplastic blood disorders characterized by the proliferation and development of immature hematopoietic cells in the bone marrow and blood" [2, 3].

The World Health Organization [4] rated Leukaemia as the 13th most common cancer with 474, 519 cases and the 10th highest cancer death with 311,594 deaths of all ages and sexes worldwide in 2020. In Nigeria burden of cancer, leukaemia was rated the third highest with 2.3% incidence and 3.2% mortality rate behind breast, cervix/uteri, and colorectum cancers in 2018 [5].

According to the report of [6] in his book titled 'A design Handbook of Haemato-oncology Chemotherapy for Medical Students and Doctors', Chronic Lymphocytic Leukaemia (CLL) is the most common Leukaemia in Africa with about 40 per cent

cases in Osun State, Nigeria whereas, in Niger-Delta region of Nigeria, Chronic myelogenous leukaemia (CML) was reported as the most common sub-type with 33.3 per cent while CLL, prolymphocytic leukaemia (PLL), and acute myeloid leukaemia (AML) accounted for 20.8%, 20.8%, and 16.7% respectively [7].

Most of these findings in Nigeria is correlated with the hematological parameters and the clinical symptoms of the patients. Patients with abnormal hematological markers such as Hemoglobin (Hb) and platelets (PLT) irregularities can experience changes from minor bleeding to deadly hemorrhage [8]. In the peripheral blood-stained film, the existence of blast cells and smudge cells are indicative of leukemia disease and these criteria are used as predictive indices of leukemia infection [2, 9].

Thrombocytopenia is a typical characteristic of liver disease in 30 to 64 per cent of leukemia infections [10, 11]. Splenomegaly in acute leukemia is known to be the primary cause of reduced platelet count [12]. Cancer-associated inflammation is a significant factor in improvements and survival of people with cancers. The systemic inflammatory response due to various causes is associated with changes in circulating white blood cells [1, 13].

Hematological analysis is done routinely in a range of clinical situations, and such tests can accurately show the severity of the inflammatory reaction in the patients [14]. This study, therefore, aimed to evaluate altered leucocyte function and hematological parameters among leukaemia patients at the Oncology Department, National Hospital, Abuja, Nigeria.

METHODOLOGY

This study was conducted in the Oncology department, National Hospital Abuja. Permission was obtained from the hospital research ethical committee at the beginning of the study. The study duration was from July 2019 to August 2020. The sample size for the study comprised 30 newly diagnosed leukaemia patients and ten healthy controls. Patients below 18 years were excluded from the study.

Sample Collection

Three millimetres (3 ml) of whole blood was collected from each study participant into Ethylene diamine tetra- acetic acid (K3EDTA) bottle for full blood count (PCV, Total leucocyte count, and differential white blood cell count) using the Mythic 22 (Orphne, Switzerland) five-part differential hematology analyzer. CD4 and CD8 T cells were carried out by flow cytometry upon diagnosis.

Data Analysis

Data analysis was done using IBM-SPSS Inc., Chicago, IL, USA version-25.0. T-test was used to compare means of between groups and the significant value was set as $P<0.05$.

RESULTS

The study comprised 30 leukaemia patients (case) and 20 healthy controls. There were 22 (73.3%) males and 8 (246.7%) females in the leukaemia group while the control group comprised 10 (50.0%) males and females. The mean age of the case was 38.9+8.8 with minimum and maximum of 26 and 62 years respectively. For the control group, the mean age was 39.0+7.5 with minimum and maximum age of 30 and 60 years respectively.

As shown in Table 1, all hematological parameters were significantly lower ($P<0.05$) in leukaemia patients as compared to control except for monocytes and basophils. Also, WBC was significantly higher in leukaemia patients (13.0 ±0.57 x 109/L) as compared to 6.11 ±1.14109/L in control ($P<0.05$). As shown in Table 2, both CD4 (775.40 ± 82.91 Cell/up and CD8 counts (634.40 +101.43 Cell/0 were significantly higher in control as compared to leukaemia patients. Also, CD4/CD8 ratio was significantly higher ($P<0.05$) among control group 1.24 ± 0.15 than leukaemia patients (1.17 ± 0.09).

Table 1: Hematological parameters and leucocytes of leukaemia patients and healthy subjects

Parameter	Case (n=30)	Control (n=20)	T-value	P-value
HGB (g/dl)	8.69± 1.50	13.78±0.51	-14.59	<0.0001
PCV (%)	28.47 ± 4.87	40.90 ± 2.22	-10.68	<0.0001
WBC (10^9/L)	13.0 ±0.57	6.11±1.14	-12.21	<0.0020
Platelets(10^9/L)	152.20 ± 46.98	243.10+57.10	-6.15	<0.0001
Neutrophils (%)	40.33 ± 7.01	52.20 ± 5.33	-6.43	<0.0001
Lymphocytes (%)	36.80 ± 5.65	49.55 ± 7.15	-7.02	<0.0001
Eosinophils (%)	2.50 ± 0.82	3.20 + 1.24	-2.41	0.0200
Monocytes (%)	4.91 ± 2.76	5.80 ±2.29	-1.19	0.2400
Basophil	0.23 ± 0.43	0.65 ± 0.81	-2.36	0.0220

HGB = Haemoglobin, PCV = Packed Cell Volume, WBC = White Blood Cell

Table 2: Immunological parameters of leukaemia patients and healthy subjects

Parameter	Case (n=30)	Control (n=20)	T-value	P-value
CD4 (Cell/u1)	115.70±68.01	775.40±82.91	-30.77	<0.0001
CD8(Cell/u1)	100.10±59.76	634.40±101.43	-23.45	<0.0001
CD4/CD8	1.17 ± 0.09	1.241±0.15	-2.11	0.0410

DISCUSSION

The findings of this study showed that leukaemia is more common among males than the females (male: female =3:1) and mostly among the middle age people. This is consistent with the previous study in Kaduna, the same North Central, Nigeria [1] who found that leukemia was three times more common among males and middle age group. This is also consistent with reports from Australia, New Zealand, Northern America, and Western Europe in which male/female leukemia ratio was found to be 4:1 [15]. A similar study in Pakistan also found higher leukemia incidence among males than females with male to female ratio of 2.1:1 [16] though some other studies reported almost equal occurrence of leukemia among males and females [17-19]. There were significant decreases in HGB and PCV levels among leukemia patients, this shows that the leukemia patients in this study were anemic. Decreased hemoglobin and packed cell volume have been associated with anemia in cancer patients [20, 21, 16].

Also, the majority of leukemia patients in our study had significantly reduced platelets and increased WBC (P<0.001). This is consistent with several studies which associated increased WBC and reduced platelets with leukemia infection which may be a proliferation of unusual WBC in the bone marrow [18, 19, 22- 25]. These findings revealed synthetic characteristics of the organs and may still stand as indicative of prognostic markers [14, 16, 18].

This study found significantly reduced CD4 and CD8 count, and CD4/CD8 ratio among leukaemia patients as compared with control. This is consistent with previous studies that associated cancer with reduced CD4 and CD8 count, and CD4/CD8 [23, 24, 26-30]. Previous studies have documented the importance of CD4 in secreting cytokines (such as interleukin-2), that is needed for the development and proliferation of CD8+ T cell [23, 31]. It has also been reported that the immunization of CD8+ T cells against cancers requires the activation of CD4+ [23]. CD4 cell counting is among the World Health Organization (WHO) important diagnostic tests required for the detection and control of disease of priority such as cancer, tuberculosis, HIV and other sexually transmitted diseases [32]. The CD4 count is classified into four groups: minimum (<200 cell/ul), low (200 - 349cells/u1), moderate (350 - 499cells/ul) and high (> 500cells/ul) [23, 26]. If CD4 cell count falls below a certain level, the patient is at risk of getting an opportunistic infection because it is the best measurement of fat patient's immune and clinical status [26, 34]. The mean CD4 count observed among leukemia patients in this study was at the minimum level (<200 cell/up, which is an indication of the patients' high risk or vulnerability to opportunistic infections. These infections do not affect people with healthy immune systems but affect people whose immune systems have been weakened by infections such as cancer and HIV [26].

The low CD4/CD8 ration among leukemia patients seen in this study is an indication of inflammatory infection which is also consistent with studies that have shown that CD4+ cell proportion and CD4+/CD8+ cell ratio in patients with cancer are significantly lower than healthy people [24, 29, 30, 35].

CONCLUSION

This study found that changes in hematological parameters are significantly associated with leukemia. The clinical and course of leukemia is associated with both CD4 and CD8 cells counts and this is indicative of the significance of the immune system in the progression leukemia. The use of therapies that boost immune response in patients with leukemia is recommended.

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