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Evaluation Of haematological parameters including prothrombin time and activated partial thromboplastin time of patients on antiretroviral therapy in federal medical Centre, Keffi, Nasarawa state, northcentral Nigeria

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Abstract

Background: Haematological parameters including prothrombin time and activated partial thromboplastin time of HIV/AIDS patients on Anti Retroviral Therapy may be a manifestation of disease suppression and / or side effects of drugs.

Objective: This study evaluated the haematological parameters including prothrombin time and activated partial thromboplastin time of adults HIV/AIDS patients on ART and compared with the negative control groups at Federal Medical Centre Keffi, Nasarawa State.

Materials and Methods: This was a case - control study involving consented 73 tests on ART and 73 HIV negative individuals who were recruited through systematic random sampling technique. Semi- structured interviewer administered questionnaire was used to evaluate their socio demographic characteristics. Venous blood samples were collected and analyzed for the above haematological, PT and APTTK parameters using Sysmex KX21 automated analyze and manual method respectively. The data were analyzed using SPSS version 20.0. A p-value of less than 0.05 was taken as statistical significant.

Results: The mean age and standard deviation of the tests and the control groups was 3.30± 10.40 years and 36.20 ± 11.70 years respectively. There were more females in both the tests (64.8%) and the control groups (56.2%) than male. The study showed a statistical significant higher leucopenia (17.8%) and neutropenia (20.5%) on the tests as compared with the control groups while anemia (45.1%) was the commonest haematological abnormalities observed in the tests on ART. The results of the clotting profile showed that thrombocytopenia (26.0%), APTT (53.4%) and PT (34.2%) were significantly more prevalent in the tests compared with the control group ($P<0.05$). There were Leucopenia, Neutropenia, Anemia, Thrombocytopenia and abnormalities in PT and APTT of the tests as compared to the control groups.

Conclusion: The results showed that participants on ART had haematological abnormalities as compared to the control group. This may guide the stake holders on appropriate decision towards better management of the patients.

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Keywords: Evaluation; Haematological parameters; ART; HIV/AIDS; Keffi; Nigeria

1. Introduction

Human Immunodeficiency virus (HIV) infection is due to reduction in CD4+ T-helper cell that is circulating in the blood system as a result of reduced immune system. The reduction of the immune system leads to the emergence of several opportunist infections, and the attendant development of the severe form of HIV infection known as Acquired Immunodeficiency Syndrome (AIDS) according to Centre for Disease Control and Prevention (CDC), 2011).

In 2021, there are about 79.3 million with a range of 55.9 million to 110 million infected with HIV since the outbreak of the disease (Abdul jalil *et al*., 2021). And about 1.7 million children less than 15 years of age and 35.9 million adults are living with HIV infection with a total of 37.7 million people with women and girls constituting 53% of the global figure. In 2020, the World Health Organization (WHO) supported this report on global summary of the Acquired Immune Deficiency Syndrome (AIDS) which revealed that about 27.5 million people were on treatment with ART. This resulted in decreasing the mortality of people infected with AIDS. This figure was compared with 2010 and 2013 report of 7.8 million and 11.7 million people respectively (Abduljalil *et al*., 2021).

Previous studies have revealed that HIV infection is associated with varying hematological abnormalities resulting in multisystem disease (Akinbami *et al*., 2010; Kyeyune *et al*., 2014). These abnormalities are caused by a variety of factors, including immune-mediated cell death, the direct cytopathogenic effects of viruses, complications from various infections and neoplasms, and medication toxicity. According to the Antiretroviral Therapy Cohort Collaboration (2009) and Passos et al. (2010), hematological abnormalities are widespread in individuals with advanced human immunodeficiency virus (HIV) infection and can impact how well anti-retroviral therapy (ART) works, leading to greater mortality. The noticeable hematological abnormalities led to the severe form of the disease particularly at the late stage of the disease, implying the high level of viral replication in the causation of disease (Kirchhoff and Silvestri, 2008; Dikshit *et al*., 2009)

Anemia is the most common hematologic condition seen in HIV-infected children and adults. Patients with advanced illness and a low CD4 cell count are more likely to experience anemia (O'Brien et al., 2005; May et al., 2010; Firnhaber et al., 2010).Other forms of haematological parameters' abnormalities include leukopenia, neutropenia, lymphopenia, and thrombocytopenia (Mathews et al., 2013; Enawgaw et al., 2014, Choi et al., 2019, (Bhardwaj et al., 2020)).

In developing countries where access to good health care is a challenge, majority of people present to health facilities lately, particularly when the disease is at advanced stage. This leads to hematological abnormalities with multiple complications (CHeCK, 2019). There has been paucity of data in the study area on the evaluation of haematological parameters including prothrombin time and activated partial thromboplastin time of people with HIV. Such data is important considering the impact of such profiles on the lives of people with HIV. Data from the study may provide a template for further interventional studies and assist the stakeholders in the management of this population of patients, and thus improving the life span of these patients. The purpose of this study was therefore to evaluate some hematological parameters including prothrombin time (PT) and activated partial thromboplastin time (aPTT) on adult HIV patients receiving anti-retroviral therapy (ART) in Federal Medical Centre Keffi, Nasarawa State.

2. Material and methods

2.1. Study area

The study was carried out between March and June 2023. The State where this study was conducted in Nigeria was Nasarawa, and the study institution was Federal Medical Centre which was at Keffi in Keffi local government area. According to the recent 2006 population census, there were 159.613 people living in the local government, and are people of several districts such as Jigwada, Kaibo Mada, Ganta, Tunayi, among others.There are 138 square kilometers of land within the local governmemt and the temperature was estimated at 30 degree centigrade. The major language of the people is Gwandara, and the major religion is Islam and Christianity. The hospital is accredited for training and has full complement of staff in the haematology unit. Keffi Local Government Area occupies a total area of 138 square kilometers and has an average temperature of 30 degrees centigrade.

2.2. Study subjects/design

The study was a case control where a total of one hundred and forty six (146) participants were recruited, this consisting of seventy-three (73) adult HIV subjects as tests attending ART in Federal Medical Center Keffi and seventy three (73) adult apparently healthy individuals as control

2.3. Inclusion Criteria

Clinically confirmed adult HIV tests attending ART clinic in Federal Medical Center Keffi that consented to the study were recruited. Those test aged 18 years and above who have been on ART for at least six months were enrolled as tests while HIV negative individual 18 years and above and consented to the study as control.

2.4. Exclusion Criteria

Patients with disease conditions known to affect levels RBC, WBC, PCV, Hemoglobin, MCV, MCH, MCHC and Platelets and clotting profile, as well as those who required emergency medical attention were excluded.

2.5. Ethical Clearance

The written application to conduct this study was sent to the Research and Ethical Committee of the FMC Keffi and their approval was gotten in accordance with Helsinki declaration, which was a code of ethics on human experimentation drafted by the World Medical Association. Informed written and verbal consent from the respondents were obtained prior to the time the study was conducted.. Each respondent was told about the advantages and disadvantages of the study, and that they were assured of their confidentiality through the study. They were also told that they were free to withdraw from the study any time they desire without affecting the level of care they were to receive.

2.6. Sample Size Determination

The minimum sample size for the study was calculated from a Fisher statistical formula for calculation of minimum sample size.

$$N = \frac{(Z1 - a)^2(P)\,(1 - P)}{d^2}$$

Where; N = minimum sample size, $Z_1 - a$ = the value of standard normal deviation which is at 95% confidence intervals has been found to be 1.96, P = the estimate of the population prevalence was 5% in Nasarawa state, Nigeria, d = the difference between the true population and the sample that can be tolerated, that is the absolute precision required (in percentage point) on either side of the population. Z1-a=1.96, P=5%=0.05, d=0.05

$$N = \frac{(1.96)^2(0.05)\,(1 - 0.05)}{0.05^2}$$

= 72.96 which is approximately 73. From the above, 73 is the approximate sample size for the study subjects. Seventy Three (73) apparently healthy individuals were recruited as control.

2.7. Sampling Techniques

The number of participants recruited for this study was 146 using systematic random sampling technique. On the clinic day, participants who fulfilled the inclusion criteria for the study were selected by the researcher. A physical examination was performed and other clinical assessments were conducted by the physicians. Then blood sample were collected by the researcher. The clinical and laboratory findings were documented into a study questionnaire.

2.8. Blood Specimen Collection And Processing

For the collection of sample, 5ml sterile syringe and needle each for a participant was used to collect 5ml of blood. The ante-cubital vein of the arm was used where tourniquet was applied 2cm above the ante-cubital fossa to distend the veins. A disinfectant (methylated spirit) was used using a cotton wool to sterilize the site. The blood was collected and was transferred into an appropriate labeled container (EDTA container). The blood was analyzed on the same day of collection. However, in the event that the analysis was not possible same day, the samples was stored frozen at 4 ^{0}C until the following day.

2.9. Estimation of Hematological Parameter

Hematological parameters were analyzed using sysmex analyzer. The three main physical technologies used in hematology analyzers were: electrical impedance, flow cytometry, and fluorescent flow cytometry. These were used in combination with chemical reagents that lyse or alter blood cells to extend the measurable parameters. The first process is to connect all waste and reagents together, and assessing the environmental conditions. Blank measurement was run and accepted. Quality control material produced acceptable results, which signifies that calibration of the analyzer was valid. Sample tube was closed and inverted at least 8 times to achieve homogenous blood sample. Sample profile was selected (Human, Male, Female, profile) Sample (ID) was identified manually. Mixed sample tube was placed on adapter and Run key on the display was pushed. The sample rotor was turn in and the needle aspirate 100microlitre of sample from the tube. Then the sampling needle was retracted, while its outer surface was automatically rinsed with diluent. After a few seconds, the sample rotor turns out. Sample tube was removed from the adapter. The auto analyzer was allowed to run the sample. Result was printed by pressing print button.

The parameters analyzed include: Total white blood cell count, lymphocyte count, mid-sized cell count, lymphocyte percentage, mid-sized cell percentage, hemoglobin concentration, red blood cell count, haematocrit, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, red cell distribution width coefficient of variation, red cell distribution width standard deviation, platelet count, platelet percentage, mean platelet volume.

2.10. Estimation of Activated Partial Thromboplastin Time

The aPTT measures the time necessary to generate fibrin from initiation of the intrinsic pathway. Activation of factor XII is accomplished with an external agent (e.g., kaolin) capable of activating factor XII without activating factor VII. Since platelet factors are necessary for the cascade to function normally, the subject is performed in the presence of a phospholipid emulsion that takes the place of these factors. The classic partial thromboplastin time depends on contact with a glass tube for activation. Since this was considered a difficult variable to control, the "activated" subject uses an external source of activation (Moon *et al*., 2017). Citrated plasma, an activating agent, and phospholipid were added together and incubated at 37 °C. Calcium were added, and the time necessary for the clumping of kaolin was measured. The normal time was usually reported as less than 30 to 35 seconds depending on the technique used. In fact, there was a normal range of about 10 seconds (e.g., 25 to 35), and decreased values ("short") may also be abnormal.

2.11. Estimation of Prothrombin Time

The first step in estimating the prothrombin time is to determine the integrity of factors VII, V, X, prothrombin, and fibrinogen pathway. This is followed through activation of the pathways, and from which the time required to generate fibrin is measure by PT. Citrated plasma and an activating agent (usually thromboplastin extracted from animal brain) were incubated at 37 °C. The plasma was re-calcified and the time was measured until fibrin filaments were observed. Each laboratory has its own normal value, usually between 12 and 15 seconds.

2.11.1. Quality control

To ensure that the authorized standard operating procedure is followed for all the investigations, a senior scientist was recruited to examine the slide for quality control. Our methodology may be reproduce by fellow researchers if they so desire.

2.12. Statistical analysis

Data collected were checked, cleaned and entered into EPI Info Version 7.0 and were exported to Statistical Package for Social Sciences (SPSS) version 22.0 (SPSS Inc., Chicago, IL, USA) for analysis. The socio-demographics were analyzed into frequency and percentage tables. Chi-square analysis was used to determine the significance of association. Mean value was compared with students t-test. Chi- square (x^2) and Fisher's exact test were used to compare the proportion of categorical variables. A p- value of < 0.05 was considered to be statistically significant.

3. Results

The age of the tests ranges from 18 years to 69 years in the HIV positive on ART with a mean age of 35.3 ± 10.4 and 19 years to 66 years in HIV negative (control) with a mean age of 36.2 ± 11.7.A higher proportion of the study respondents were females with 64 .8% and 56.2 % in the tests and control groups respectively. There was no statistically significant difference between the two groups of respondents on the basis of their age, sex, education, occupation marital status, domicile and income (table 1).

Table 1 Socio-demographic characteristics of the tests and controls

Variable	Tests, N = 73 n (%)	Control, N = 73, n (%)	Chi-square	p-value
Age group (in years)			2.939	0.709
<20	2 (2.7)	3 (4.1)		
20 – 29	19 (26.0)	17 (23.3)		
30 – 39	30 (41.1)	31 (42.5)		
40 – 49	16 (21.9)	11 (15.1)		
50 – 59	4 (5.5)	6 (15.1)		
≥ 60	2 (2.7)	5 (6.8)		
Mean age ± SD	`35.3 ± 10.4	36.2 ± 11.7	-0.449[t]	0.654
Sex			1.030	0.310
Male	26 (35.6)	32 (43.8)		
Female	47 (64.8)	41 (56.2)		
Education			1.441	0.230
Informal	19 (26.0)	13 (17.8)		
Formal	54 (74.0)	60 (82.2)		
Occupation			1.536	0.820
Student	16 (21.9)	14 (19.2)		
Farmer	18 (24.7)	21 (28.8)		
Artisan	15 (19.2)	18 (24.7)		
Civil Servant	14 (19.2)	18 (24.7)		
Trader	10 (13.7)	7 (9.6)		
Marital Status			2.090	0.554
Single	14 (19.2)	12 (16.4)		
Married	41 (56.2)	48 (65.8)		
Divorced/Separated	10 (13.7)	9 (12.3)		
Widowed	8 (11.0)	4 (5.5)		
Domicile			0.991	0.320
Rural	42 (57.5)	36 (49.3)		
Urban	31 (42.5)	37 (50.7)		
Income			1.947	0.163
Below poverty line (<$2.15/ day	44 (60.3)	52 (71.2)		
Above poverty line (≥$2.15/ day	29 (39.7)	21 (28.8)		

In this study, 17. 8% of the tests had leucopenia as compared to 4.1% of the control. There was statistically significant difference between the tests and the control (P = 0.08), similarly 20.5% of the tests had neutropenia as compared to 5.5% of the control. There was statistically significant difference between the tests and the control (P = 0.007), Furthermore, 26.0% of the tests had thrombocytopenia as compared to 11.0% of the control. There was statistically

significant difference between the tests and control (P = 0.019). Also 45.1% of the tests had Anemia as compared to 9.6% among the controls. There was statistically significant difference between the tests and the control (P = 0.001).

Furthermore, there was a statistically significant difference observed in the haematological abnormalities between the tests and the control in RBC (P = 0.014), Hemoglobin (P = 0.002), MCH (P = 0.007), and MCHC ((P = 0.008) (table 2).

Table 2 Comparison of the categorized haematological parameters between the tests and controls

Variable	Tests N = 73 n (%)	Control N = 73 n (%)	Chi-squared	p-value
WBC				
Normal	60 (82.2)	70 (95.9)	7.019	0.008
Abnormal	13 (17.8)	3 (4.1)		
Neutrophil				
Normal	58 (79.5)	69 (94.5)	7.321	0.007
Abnormal	15 (20.5)	4 (5.5)		
Eosinophil				
Normal	38 (52.1)	67 (91.8)	28.522	<0.001
Abnormal	35 (47.9)	6 (8.2)		
Lymphocyte				
Normal	50 (68.5)	64 (87.7)	7.844	0.005
Abnormal	23 (31.5)	9 (12.3)		
Monocyte				
Normal	69 (93.2)	72 (98.6)	2.781	0.095
Abnormal	5 (6.8)	1 (1.4)		
Platelet				
Normal	54 (74.0)	65 (89.0)	5.498	0.019
Abnormal	19 (26.0)	8 (11.0)		
Packed Cell Volume				
35 – 44	24 (32.9	46 (63.0)	25.426	<0.001
30 – 34	16 (21.9)	20 (27.4)		
25 – 29	19 (26.0)	6 (8.2)		
20 – 24	12 (16.4)	1 (1.4)		
<20	2 (2.7)	0 (0.0)		
Haemoglobin				
Normal	50 (68.5)	65 (89.0)	9.215	0.002
Abnormal	23 (31.5)	8 (11.0)		
RBC				
Normal	61 (83.6)	70 (95.9)	6.018	0.014
Abnormal	12 (16.4)	3 (4.1)		

MCV				
Normal	69 (94.5)	72 (98.6)	1.864	0.172
Abnormal	4 (5.5)	1 (1.4)		
MCH				
Normal	58 (79.5)	69 (94.5)	7.321	0.007
Abnormal	15 (20.5)	4 (5.5)		
MCHC				
Normal	60 (82.2)	70 (95.9)	7.019	0.008
Abnormal	13 (17.8)	3 (4.1)		

In the current findings, 53.4% of the tests had activated partial thromboplastin compared to 5.5% of the control group with statistically significant difference (P < 0.001), in the same vein, there was statistically significant difference between the prothrombin time (34.2%) of the tests and the control (9.6%) group (P< 0.001) table 3.

Table 3 Comparison of the categorized PT andAPTT between the tests and controls

Variable	**Tests N = 73 n (%)**	**Control N = 73 n (%)**	**Chi-squared**	**p-value**
Platelet				
Normal	54 (74.0)	65 (89.0)	5.498	0.019
Abnormal	19 (26.0)	8 (11.0)		
APTT				
Normal	34 (46.6)	69 (94.5)	40.382	<0.001
Abnormal	39 (53.4)	4 (5.5)		
PT				
Normal	48 (65.8)	66 (90.4)	12.967	<0.001
Abnormal	25 (34.2)	7 (9.6)		

This study evaluated the mean value for both the tests and the control group and found that there was a statistically significant relationship between the mean value of the tests and the control groups in WBC (P< 0.001) Neutrophil (P<0.001) PCV (P< 0.001). However, there was no statistically significant difference in the mean value of both the tests and the control groups in MCV (P = 0. 817) and MCHC (P= 0.423) table 4..

Table 4 Comparison of the mean haematological parameters between the tests and controls

Variable	**Tests N = 73 Mean ± SD**	**Control N = 73 Mean ± SD**	**t-subject**	**p-value**
WBC	4.7 ± 1.2	5.6 ± 1.1	-5.231	<0.001
Neutrophil	46.2 ± 10.2	55.1 ± 8.6	-5.668	<0.001
Eosinophils	5.7 ± 2.5	3.6 ±1.6	6.035	<0.001
Lymphocytes	42.7 ± 9.6	37.2 ± 7.5	3.855	<0.001
Monocyte	3.6 ± 1.8	4.4 ± 1.5	-2.856	0.005

Packed Cell Volume	31.2 ± 7.1	36.2 ± 5.2	-4.879	<0.001
Haemoglobin	11.0 ± 2.3	12.0 ± 1.6	-3.038	0.003
RBC	4.4 ± 0.7	4.7 ± 0.5	-2.461	0.015
MCV	87.6 ± 5.9	87.4 ± 2.7	0.232	0.817
MCH	27.4 ± 1.2	28.1 ± 1.0	-3.835	<0.001
MCHC	33.7 ± 1.7	33.7 ± 1.3	-0.803	0.423

Similarly, concerning the clotting factors, there was a statistically significant difference between the mean value of the tests and the control groups in platelets (P< 0.001) APTT (P.< 0.001) and prothrombin time (P< 0.001) table 5.

Table 5 Comparison of the mean PT and APTT between the tests and controls

Variable	**Tests N = 73 Mean ± SD**	**Control N = 73 Mean ± SD**	**t-subject**	**p-value**
Platelets	188.1 ± 41.2	231.4 ± 49.8	-5.723	<0.001
APTT	34.1 ± 5.8	27.2 ± 3.2	8.950	<0.001
Prothrombin time	13.6 ± 1.1	11.9 ± 1.3	8.701	<0.001

4. Discussion

The study evaluated the hematological parameters including PT and PTTK of Adult HIV positive patients receiving ART in FMC. The higher proportion of the tests were in the age groups 30 – 39 years. The mean age for both tests and the control groups was 35.3 ± 10.4 and 3.2 ± 11.7 years respectively. This is comparable to the findings of another study (Balogun et al; 2020) where the mean age for the tests and the controls was 37.86 and 32.28 years respectively. It was also similar to the previous studies earlier reported in literature (Olufemi et al; 2008). This is not surprising given the fact that HIV was prevalent in the younger age groups. This result would have a negative effect on the standard of living of the people, because this population forms the majority of the labor force.

In this study, females were the predominant genders. The observed predominance of female gender as compared to male gender is consistent with global occurrence in which females were noted with increase at risk of contracting HIV infection compared to male. Previous studies have identified females to be prone to microtrauma during sexual activity due to their large surface areas exposed to contact. This in addition to other associated factors such as gender inequality, poor standard of living, and early exposure to sex (Wojcicki J. 2005) and Olufemi et al, 2008).

In the same vein majority of the tests in this study were leaving below poverty level, this finding was comparable with (Adegbamigbe et al; 2012), in another rural study centre where majority of her tests were of low social economic status. The association between poor social economic status and contracting HIV/AIDS have been reported in previous study and was due to riskier health behaviors such as early sexual exposure and unprotected sexual intercourse (Krueger et al, 1990).

The target organ for the mean abnormalities of HIV/AIDS is related to marrow and blood, although virtually all organs in the body are affected. The haematological complications due to HIV/AIDS are countless of which the use of ART has been reported to improve the life of the patients. The abnormality in the haematological parameters that occurs due to HIV infection may lead to high morbidity and mortality (Cossy CD 2007), (Salond E. 2005).

In this study 17.8% of the tests had leucopenia as compare to 4.1% among the controls. The mean WBC in the tests was lower than the control groups and was statistically significant. This finding was comparable with several previous study than reported leucopenia finding among subject of ART compare with the control (Adetifa et al;2006), (Erhabor, et al; 2005), (Rahmana et al ; 2014). In a previous study, Chukwuezi et al, 2013 had found that individuals who were HIV positive, had reduced total white cell count unlike individuals who were HIV negative. Other study concluded that the

second leading abnormality of haematological parameters n patients with HIV infection is leucopenia (Tagoe, DNA and Asantewa, E. 2011). The mechanism of leucopenia may be due to inhibition of leucopoiesis by the virus.

In this current study, thrombocytopenia was observed as higher among HIV tests on ART than the control (26.0% VS 11.0%, P = 0.019). The findings in this study is comparable to 27.0% found by Saurez et al; 1994). There was a statistical significant relationship between the mean thrombocytopenia of the tests and the control groups. This finding is consistent with Balogun et al, 2020 and Tagoe et al; 2011 which shows a statistical significant relationship between the subjects and control groups. This findings may be due to the fact that majority of tests have normal platelet count. The mechanism of thrombocytopenia in HIV positive patients may be immune mediated due to increased platelets destruction or reduced production.

Also, the current finding revealed that 20.5% of the tests had neutropenia as compare to5.1% among the controls is comparable with the previous study reported by Attili et al; 2008 where the percentage of neutropenia was 22.7%. The findings were found to be lower when compared to the prevalence rate of 41.0% reported by Saurez et al; 1994. In a study by (Coyle 1994), the study reported neutropenia as the most common abnormality affecting the white cells of the body in HIV infected subjects. The mean neutrophil in the tests (4.2± 10.2) was lower than the control groups (55.1± 8.6) and was statistically significant.

In this current study, 45.1% of the tests had anemia, as compared to 9.6% among the controls. The findings was lower when compared to the prevalence rate of 77.0% reported by Adetifa et al; 2006, 57.5% reported by Orji er al; 2017, 73. 5% reported by Aaron er al; 2021, 69.7% reported by Omoregie er al; 2013 in Benin. The current study revealed a statistically significant relationship between the mean PCV of the subject (31.2 ± 7.1) and control groups (36.2 ± 5.2). The finding of the differences in the mean haematocrit values of the tests and controls corroborate a previous report by Balogun et al; 2020 in Edo state Nigeria and by Decarvaiho et al, 2010 in Pretoria South Africa. This corroboration is in support of previous studies on the finding of anaemia as the common haematological abnormality found in HIV infection. Severe anaemia is a common causes of progression of HIV infection to AIDS (Munyazesa et al; 2012, Adetifa et al; 2006.

Prothrombin time (PT) is a subject of extrinsic pathway, and a reduced PT values due to high coagulation is expected. However, in this current study, the prothrombin time (PT) value was significantly higher in the HIV positive patients on ART (tests) compared to the HIV negative control. This finding was in agreement with the studies done in Anambra State of Nigeria (Ifeanyi Chukwu et al; 2016). Also, another study conducted in 2013 reported a significantly higher PT values in the subjects than the controls (Abdullahi et al; 2013). Similarly studies conducted in Jimma and Gondar town of Ethopia (Tesfaye et al; 2015) Seyoum et al; 2018, India Youmash et al; 2018) and the Northerlands (Jong et al; 2009) also found significantly higher PT values in subjects than in control. Higher PT found in this study is similar to finding in 2009 and was due to endothelia changes (Awodu et al; 2009)

The current study revealed a statistically relationship between the mean prothrombin time (PT) of the tests (13. 6 ± 1.1) and control groups (11.9 ± 1.3). Previous study revealed that HIV patients on ART may develop injury to the liver cells, a common manifestation in HIV patients on ART. HIV infection has been associated with endothelia damage, liver disease and increment of predisposing factors for hypercoagulable state such as presence of anti – cardiolipin antibodies and lupus anti- coagulant and deficiencies of protein C, protein S, heparin Cofactor II and anti-thrombins which cause activation and consumption of coagulation factors that can affect the PT value (Solages et al; 2006, Andrade et al; 2006, Y.M.P. Shen and E.P. Frenkel 2004.

Activated partial thromboplastin time (aPTT) is a subject of intrinsic pathway. This current study found a significantly higher aPTT values in tests than in control (53.4%) and (5.5%) respectively. This current study was lower when compared to the prevalence rate of 55.3 done by (Ephraim et al; 2018). The current study revealed a statistically relationship between the mean activated partial thromboplastin time (aPTT) of the tests (34.1 ± 5. 8) and control groups (27.2 ± 3.2). A study has implicated anti-phospholipid in the aetiology of prolonged aPTT in patients with HIV infection due to its effect on clinical and biochemical parameters.

In this current study platelet was observed as lower among HIV tests on ART than control. This finding is comparable with the study done by Awodu et al; 2009 which had 22.4%. Also, the study was higher when compared to the prevalence rate of 16% reported by Paloma et al; 2003, 21% reported by Abdullahi et al; 2013 and 22.4% reported by Awodu et al; 2009. Platelet count was significantly low in HIV individual on ART compared to HIV negative controls. Studies done by Roman et al; 2016, and Omoregie et al; 2009, compared low platelet count in HIV patients on ART to healthy controls. The current study revealed a statistically relationship between the mean platelet of the tests (1.88.1 ± 49.8). The causes of low platelet value in HIV patient on ART might be as a result of increased immune mediated destruction of platelet, presence of antiplatelet specific antibodies and direct infection of megakaryocytes by HIV.

Thrombotic thrombocytopenic purpura, impaired hematopoiesis (Parinithaet et al; 2012), and damaging of the liver by the HIV infected patient on ART.

Limitations

The current study is conducted in one center, and being a hospital-based design, interpretations of the results should not be generalized. A study involving multiple centers particularly in the community with large sample size is recommended. The measurement of the clotting profile (PT, APTT) were done manually, which was subjective with possibility of observe error, future study using coagulometer to measure clotting profile is recommended. Despite these limitations, the study generates distinctive information regarding the abnormalities in the haematological parameters and the clotting profile of the tests on ART. This finding will assist the stakeholders in the management of the patients.

5. Conclusion

In thus study, a total of 73 tests on ART and 73 negative control groups were evaluated for haematological parameters and some clotting profile. The mean age of the tests and the control groups was 35.3 ± 10.4 and 36.2 ± 11.7 respectively. The majority were in the age range of 30 to 39 years. There were more females than males. Also, there were leucopenia, neutropenia, anemia, thrombocytopenia and abnormalities reported in prothrombin time (PT) and Activated partial thromboplastin of the tests as compared to the control groups $P < 0.05$).

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflicts of interest.

Statement of ethical approval

Ethical approval for this study was approved by the Ethics and Research Committee of Federal Medical Centre, Keffi, Nasarawa State before the study was conducted.

Statement of informed consent

Informed written and verbal consent from the respondents were obtained.

Availability of data and materials

The datasets for this study would be made available from the correspondence author on a reasonable request.

Authors' contribution

- KOI - Conceptualization, Data curation, Formal analysis Methodology, Writing original draft.
- KEA: Formal analysis, Supervision, Methodology, Writing review and editing
- AOI: Formal analysis, Supervision, Writing review and editing
- Others: Data analysis, Writing review and editing

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