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Original Research Article

Blood Biological Parameters of Population Living with HIV/AIDS on Antiretroviral Therapy in Integrated Centre for Bioclinical Research of Abidjan (Côte d'Ivoire)

Soualio Kamagate[1], Mathieu Nahounou Bleyere[2*], Howélé Ouattara[1], Thomas D'Aquin Toni[3], Paul Angoué Yapo[2]
[1]Training and Research Unit of Biological Sciences, Peleforo Gon Coulibaly University of Korhogo, BP 1328 Korhogo (Côte d'Ivoire)
[2]Training and Research Unit of Nature Sciences/ Laboratory of Physiology, Pharmacology and Phytotherapy, Nangui Abrogoua University, 02 BP 801 Abidjan 02, Côte d'Ivoire
[3]Integrated Centre for Bioclinical Research of Abidjan (ICBRA), 02 BP 520 Abidjan 02, Côte d'Ivoire

***Corresponding Author:**
Mathieu Nahounou Bleyere
Email: bleyere@yahoo.fr

Abstract: To assess changes of blood parameters in people living with HIV on antiretroviral therapy, a follow-up study was carried out subjects. A group of 45 subjects in ICBRA (Integrated Centre for Bioclinical Research of Abidjan) with HIV infection were recruited with a mean age was 26.1 ± 0.7 years. These Patients were followed by control of some blood parameters before initiating (J0) antiretroviral therapy. These same biological parameters were assessed after 6 (M6) and 12 (12M) months. The results of study was indicated a decrease of anaemia prevalence during follow-up ((51.1%, 42.2% and 40% respectively at J0, M6 and M12. In the same way, during treatment, microcytic hypochromic anaemia and macrocytic hypochromic anaemia were more observed. Moreover, these two types of anaemia were more revealed according to CD4 classes. In addition, the prevalence of neutropenia was observed in 55.6% at the beginning of treatment, it was decreased to 37.8% at M6. Lymphopenia was reported only in 2.2% of patients at treatment initiation. As for thrombocytopenia, it was revealed in 11.1% of subjects at treatment initiation. In the sixth and twelfth months of treatment, it was recorded respectively in 11.1% and 8.9% of subjects. According to the CD4 count, high prevalence of leukopenia to class B and class C for initiation of neutropenia and lymphocytosis to classes A and B and monocytosis all classes were observed. This study revealed a non-significant increase in CD4 count. The majority of patients had normal glucose levels during follow-up (93.4%, 95.6% and 97.8% respectively at J0, M6 and M12). Normal rate of creatinine was also indicated (73.3%, 71.1% and 84.4% respectively at J0, M6 and M12) and alanine aminotransferase levels (ALT) (88.9%, 84.4% and 82.2% respectively at J0, M6 and M12).
Keywords: Blood parameters, HIV infection, Antiretroviral therapy, ICRBA (Côte d'Ivoire).

INTRODUCTION

HIV/AIDS is now a development issue and safety concern across the planet. The fight against this pandemic is undoubtedly one of the major challenges of the 21st century. This struggle is to ensure the harmonious development of our nations and guarantee the quality of living. According to WHO estimates [1], Côte d'Ivoire remains one of the most affected countries in the West African under area with a prevalence of 2.7%.

As other sub-Saharan African countries faced the scourge of HIV/AIDS infection, Côte d'Ivoire has made the fight against AIDS a priority of government action. To this end, the vast majority of people with HIV are supported medically. These people benefit from antiretroviral therapy. The goal of this treatment is to extend and improve the quality of life, reduce the viral load to the lowest level as long as possible, preserve and/or restore immune function, reduce morbidity and HIV-related mortality and optimize treatment adherence [2, 3]. The therapeutic success of this treatment is associated with a very high level of control and monitoring of blood parameters from treatment initiation. Investigations have allowed to assess the effectiveness of treatment regimens and abnormal blood parameters related there too [4, 5, 6]. However, Côte d'Ivoire despite several studies reported on the effect of antiretroviral on some blood parameters [7, 8, 9]. Very little has been done on the monitoring of these parameters in people living with HIV/AIDS receiving treatment in time. Therefore, it is important to initiate this study in order to evaluate the possible changes of blood parameters in this population for 12 months followed in the Integrated Centre for Bioclinical Research of Abidjan (ICBRA), a center specializing in

care of people living with HIV/AIDS. This study helps to assess any haematologic, biochemical and CD4 count abnormalities of patients over followed 12 months. In addition, it serves to highlight the prevalence of types of anaemia and changes of these blood parameters as CD4 classes according to the monitoring time.

MATERIAL AND METHODS

Study population

This study was conducted from january 5, 2015 to january 8, 2010 in the Integrated Centre for Bioclinical Research of Abidjan (ICBRA). After obtaining permission from the authorities of ICRBA and patients consent, 150 HIV-positive subjects on antiretroviral treatment and followed in the same center were recruited. Only 45 of 150 HIV-positive (30%) were able to have biological assessments to the inclusion of treatment, at six months and twelve months.

These seropositive subjects were screened through three types of HIV serology tests (Test Determines, STAT-PAK III Engineering and Test (HIV-1 / HIV-2).

Characteristics of subjects

Sociodemographic characteristics of the study population are indicated in Table 1. It found that of 45 patients in the study, 27 or 60% were women against 18 or 40% men gender. These subjects are 18 to 35 years with mean age of 26.1 ± 0.7 years. In the same table, the study selected a small proportion (13.3%) of adolescents compared to those whose age is physiologically normal (86.7%). Body mass index was abnormal (underweight and overweight) in 46.7% (Table 1). The study population was presented good education according to various levels. In addition, 91.1% of subjects were HIV1 infected against 8.89% with HIV2 (Table 1). in the same way, any subject was infected with HIV1-2. These selected people with HIV are mostly different districts of Abidjan (Table 1).

Table 1: Characteristics and HIV types of study population

Social characteristics and HIV types	Manpower (N) N=45	Percentages (%)
Sex		
Men	18	40
Women	27	60
Age (years)	26.1 ± 0.7	
18-19	6	13.3
20-35	39	86.7
BMI (kg/m^2)	25.18±0.4	
< 19,8	5	11.1
19,8 – 26	24	53.3
> 26	16	35.6
Education attainment		
Uneducated	5	11.1
primary school	20	44.4
Secondary school	13	28.9
Superior	7	15.6
Residence		
Abidjan	42	93.3
suburbs	3	6.7
HIV types		
VIH-1	41	91.1
VIH-2	4	8.9
VIH-1and 2	00	00

N : Total number of each subject group ; BMI: Index of Body Mass

Blood samples and assays of biological parameters

In each of enrolled subjects, three blood samples were taken on an empty stomach first morning of the first day (D0) of initiation of treatment, then six months (M6) after, and finally twelve months (M12) after. The blood collected from each patient was collected in three different tubes namely dry tube, gray and purple tube of 5 ml each. Whole blood collected on purple tubes with anticoagulant (EDTA) has achieved the CD4 counts by flow cytometry with Fascalibur® and blood count by the Sysmex PLC XT 2000i. The collected blood in gray and dry tubes was centrifuged at 1107 Newton for five minutes to obtain the serum.The obtained serum in the dry tubes has allowed to determine HIV status and biochemical data. However, the obtained plasma in the gray tubes has allowed determine of blood glucose. For HIV status, the most used technics in the care centers are the three successive tests namely Determine, Stat Pak and Engineering III HIV-1/HIV-2. The quantitative determination of biochemical parameters (glucose, creatinine, ALAT) was based on a colorimetric technic available on most automated COBAS INTEGRA 400.

Assessment and statistical analysis of biological parameters

The study results were expressed in means associated standard error of mean (SEM). Some other results were indicated by proportions. For the operation of various parameters of the study, several statistical tests were used. The statistical significance was defined for a p-value less than 0.05. The comparison of means biological parameters of subjects living with HIV on treatment during follow-up was performed by analysis of variance (ANOVA 1). They have allowed to assess the possible changes of blood parameters of our subjects. In these analyzes, the dependent variables were 17 biological parameters. The three periods of sampling (D0, M6 and M12) were independent data. The different observed proportions of blood biomarkers were compared with the likelihood test or G test log likelihood ratio software version R.2.0.1 Windows [10].

Ethics

Experimental procedures and protocols used in this study were approved by ethical committee of Health Sciences, Integrated Centre for Bioclinical Research of Abidjan. These guide line were in accordance with the internationally accepted principles for laboratory use and care. Then, this study was approved by the Ministry of Higher Education and Scientific Research and the Ministry of Health and Public Hygiene in the Republic of Côte d'Ivoire.

RESULTS

Distribution red cell and thrombocytes parameters

In Table II were presented the mean values of erythrocytes and the red cell parameters proportions for subjects on treatment HIV infection. No significant differences ($p > 0.05$) were observed between the mean values during follow-up on day 0, M6 and M12. In addition, for red blood cell parameters proportions, no significant difference ($p > 0.05$) were reported between normal and abnormal proportions values for hemoglobin and hematocrit levels. In the same way, the proportions of above normal values of mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) were not significantly different. However, a significant difference ($p < 0.05$) was revealed between proportion of normal and higher values of mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH). In this table were also shown that prevalences of anaemia was 51.1% at beginning and was decreased to 42.2% and 40% respectively in M6 and M12.

For mean corpuscular volume (MCV), macrocytosis prevalence was increased during follow-up. It was 33.3% at starting and to 44.4% and 53% respectively in M6 and tM12. In addition, during the monitoring, the majority of patients had normal platelets (Table 2).

Changes in leukocyte parameters and CD4 count

Means and proportions of the leukocyte parameters of patients during follow-up were summarized in Table 3. No significant differences ($p > 0.05$) were observed between the mean values of leukocyte and immunological parameters during follow at D0, M6 and M12. In this table, the prevalences of leukocyte, eosinophils, basophils, neutrophils, monocytes lymphocytes and different CD4 values according to reference values were indicated no significant difference ($p > 0.05$) during follow-up. By cons, significant differences ($p < 0.05$) were observed between other leukocyte parameters proportions.

Moreover, the prevalence of neutropenia was 55.6% at baseline and decreased to 37.8% at six months then increased by 51.1% in the twelfth month of treatment. As for the prevalence of lymphocytosis, it was the most appropriate early treatment and twelve months of treatment. In sum, the prevalence of neutropenia and lymphocytosis were modified throughout the monitoring. Furthermore, an increase in CD4 count over time has been revealed.

Variation of biochemical parameters

Comparison analysis of means and proportions of biochemical parameters were shown in table IV. In this table, it is indicated that no significant difference was observed between the mean values of these parameters during follow-up ($p > 0.05$). The study results were revealed that for all proportions of biochemical parameters, excluding abnormal values in blood glucose levels (< 0.7 g/L) and creatinine (> 11 or > 12.5), no statistically significant difference ($p > 0.05$) were revealed between proportions of biochemical parameters during follow-up. However, the highest prevalence of these parameters were observed during the twelfth month (M12) of treatment unless the ALT levels was high at baseline (Table 4).

Moreover, at baseline, 93.4% of patients had normal glucose levels. During follow-up, the rate was increased to 95.6 % to 97.8 % in six and twelve months, respectively. Regarding the prevalence of serum creatinine (73.3%, 71.1% and 84.4% respectively for the inclusion in the sixth and twelfth month of treatment) and ALT (88.9%, 84, 4% and 82.2% respectively for the inclusion in the sixth and twelfth month of treatment).

Table 2: Mean values and proportions of the erythrocyte and thrombocyte parameters during the treatment

Erythrocytes and thrombocytes parameters	D0 n	D0 M±SEM	D0 %	M6 n	M6 M±SEM	M6 %	M12 n	M12 M±SEM	M12 %	p
Red blood cells (1012/l)		4.1 ± 0.1			4.1 ± 0.1			4.1 ± 0.1		> 0.05 (NS)
< 4 ou < 4,5		23	51.1		22	48.9		26	57.8	0.1 (NS)
4-5,4 ou 4,5-6		21	46.7		22	48.9		19	42.2	0.2 (NS)
> 5,4 ou 6		1	2.2	1		2.2	0		0	0.2 (NS)
Hemoglobin (g/dl)		12 ± 0.3			12.4 ± 0.2			12.5 ± 0.2		> 0.05 (NS)
< 12 ou < 13		23	51.1		19	42.2	18		40	0.1 (NS)
12-16 ou 13-18		22	48.9		26	57.8	27		60	0.1 (NS)
Hematocrit (%)		37.3 ± 0.8			38.2 ± 0.7			37.9 ± 0.6		> 0.05 (NS
< 35		15	33.3		10	22.2	9		20	0.07 (NS)
35-47		30	66.9		35	77.8		36	80	0.05 (NS)
MCV (fl)		91.8 ± 2.1			94.3 ± 1.9			93.6 ± 1.9		> 0.05 (NS)
< 85		12	26.7		11	24.4		12	26.7	0.4 (NS)
85 – 95		27	60		14	31.1	9		20	$4.5.10^{-6}$ (S)
> 95		15	33.3		20	44.4		24	53.3	0.02 (S)
MCH (pg)		29.6 ± 0.8			30.7 ± 0.7			30.9 ± 0.7		> 0.05 (NS)
< 27		10	22.2		10	22.2		10	22.2	0.5 (NS)
27-31		19	42.2		12	26.7		10	22.2	0.01 (S)
> 31		16	35.6		23	51.1		25	55.6	0.02 (S)
MCHC (g/dl)		32.2 ± 0.3			32.5 ± 0.3			33.1 ± 0.3		> 0.05 (NS)
< 32		25	55.6		17	37.8		15	33.3	0.01 (S)
32-36		20	44.4		28	62.2		30	66.7	0.01 (S)
> 36	0		0	0		0	2		4.4	0.008 (S)
Thrombocytes (10^3/mm^3)		248±18.8			226.9±10.5			238.2±11.7		> 0.05 (NS)
< 150		5	11.1		5	11.1	4		8.9	0.6 (NS)
150-500		39	86.7		40	88.9		41	91.1	0.06 (NS)
> 500		1	2.2	0		0	0		0	0.09 (NS)

D0: Day of antiretroviral therapy starting, M6: Month 6 of antiretroviral therapy, M12: Month 12 of antiretroviral therapy, SEM: Standard error of mean n: Observed subjects' number in each group, MCV: Mean corpuscular volume; MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration, S: Statistically different for p value <0.05; NS: Not statistically significant for p value >0.05

Table 3: Mean and proportions values of leukocyte and CD4 parameters

Leukocytes and CD4 parameters	D0			M6			M12			p values
	n	M±SEM	%	n	M±SEM	%	n	M±SEM	%	
Total leukocytes (10^3/mm^3)		5 ± 0.3			4.8 ± 0.2			4.7 ±0 .2		> 0.05 (NS)
< 4	18		40	16		35.6	13		28.9	0.2 (NS)
4 – 10	25		55.6	28		62.2	32		71.1	0.07 (NS)
< 10	2		4.4	1		4.4	0		0	0.03 (NS)
Neutrophils (%)		38.9±1.7			41.3±1.7			39.7±1.8		> 0.05 (NS
< 40	25		55.6	17		37.8	24		53.3	0.04 (S)
40–70	19		42.2	28		62.2	21		46.7	0.03(S)
> 70	1		2.2	0		0	0		0	0.09 (NS)
Eosinophils (%)		4.3±0.7			4.6±0.6			3.9±0.6		> 0.05 (NS)
<1	2		4.4	2		4.4	2		4.4	0.09 (NS)
1–5	34		75.6	27		60	36		80	0.02 (S)
> 5	9		20	16		35.6	7		15.6	0.006 (S)
Basophils (%)		0.5±0.04			0.4±0.04			0.4±0.04		> 0.05 (NS)
0-1	44		97.8	43		95.6	43		95.6	0.05 (NS)
> 1	1		2.2	2		4.4	2		4.4	0.6 (NS)
Lymphocytes (%)		44.7±1.5			43.6±1.4			43.6±1.4		> 0.05 (NS)
< 15	1		2.2	0		0	0		0	0.09 (NS)
15–40		11 24.4		20		44.4	12		26.7	0.01 (S)
> 40		33 73.3		25		55.6	33		73.3	0.03 (S)
Monocytes (%)		11.7±0.7			10.7±0.4			10.7±0.4		> 0.05 (NS)
2 –10		20 44.4		20		44.4	19		42.2	0.3 (NS)
> 10		25 55.6		25		55.6	26		57.8	0.2 (NS)
TCD4 lymphocytes (/mm^3)		437.7±43			441.7±37			464.9±38		> 0.05 (NS)
< 200	11		24.4	6		13.3	7		15.6	0.09 (NS)
200 – 499	18		40		21 46.7		19		42.2	0.2 (NS)
≥ 499	16		35.6	18		40		19 42.2		0.2 (NS)

D0: Day of antiretroviral therapy starting, M6: Month 6 of antiretroviral therapy, M12: Month 12 of antiretroviral therapy, SEM: Standard Mean of error, n: Observed subjects' number in each group, S: Statistically different for p value <0.05, NS: Not statistically significant for p value >0.05.

Table 4: Mean and proportions of biochemical parameters

Biochemical parameters	D0			M6			M12			p values
	n	M±SEM	%	n	M±SEM	%	n	M±SEM	%	
Glycemia (g/L)		0.9±0.02			0.9±0.03			0.9±0.03		> 0.05 (NS)
< 0,7	2		4.4	1		2.2	0		0	0.04 (S)
0,7-1,10	42		93.4	43		95.6	44		97.8	0.06 (NS)
> 1,10	1		2.2	1		2.2	1		2.2	0.9 (NS)
Creatinemia (g/L)		7.6±0.4			7.7±0.4			7.5±0.4		> 0.05 (NS)
<5,5 ou <6,5	9		20	10		22.2	7		15.6	0.3 (NS)
5,5-11 ou 6,5-12,5	33		73.3	32		71.1	38		84.4	0.06 (NS)
> 11 ou >12,5	3		6.7	3		6.7	0		0	0.003 (S)
ALAT (UI/L)		21.9±2.07			25.2±2.5			28.4±3.5		> 0.05 (NS)
<5	0		0	0		0	1		2.2	0.09 (NS)
5-40	40		88.9	38		84.4	37		82.2	0.06 (NS)
> 40	5		11.1	7		15.6	8		17.8	0.3 (NS)

D0: Day of antiretroviral therapy starting, M6: Month 6 of antiretroviral therapy, M12: Month 12 of antiretroviral therapy, SEM: Standard error on the Mean, n: Observed subjects number in each group, ALAT: Amino-Transférase Alanine, S: Statistically different for p value <0.05, NS: Not statistically significant for p value >0.05.

Prevalence of anaemia types according to HIV infection progression

The evolution of anaemia types during follow-up of HIV infection patients on antiretroviral treatment (Table 5) was indicated that the hypochromic microcytic anaemia and hypochromic macrocytic anaemia were the most frequent observed (hypochromic microcytic anemia 20%, 17.8% and 20% respectively at D0, M6 and M12 and hypochromic macrocytic anaemia 13.3%, 13.3% and 20% respectively at D0, M6 and M12).

The variation of anaemia types according to CD4 class during follow-up was revealed that C stage, the prevalence of hypochromic microcytic anaemia was decreased significantly ($p < 0.05$) from initiation to sixth month and significantly increased ($p < 0.05$) from sixth to twelfth month of treatment (6.7%, 0% and 6.7% respectively at D0, M06 and M12). This table have also revealed that A class, the prevalence of normochromic normocytic anaemia not decreased significantly ($p = 0.09$) during follow-up (8.9%, 4.4% and 2.2% respectively D0, M06 and M12). Furthermore, low levels of normochromic normocytic anaemia and normochromic macrocytic anaemia were significantly different ($p = 0.04$). This observation were more present at initiation (2.2%) and in the sixth month of treatment (4.4%).

Analysis of the results obtained from the classification based on HIV infection progression and components of different types of anaemia is included in table V. In A class, the prevalence of hypochromic microcytic anaemia was more present and did not change throughout the follow-up (11.1%). In this class, the prevalence of hypochromic macrocytic anaemia increased not significantly ($p > 0.05$) during follow-up (2.2%, 4.4% and 8.9% respectively D0, M6 and M12). As for normochromic normocytic anaemia, the prevalence was 2.2% at initiation, disappeared during follow-up. Moreover, normochromic macrocytic anaemia was observed only in the sixth month of treatment. In B class, hypochromic microcytic anaemia has increased not significantly ($p > 0.05$) from initiation to sixth months to not decrease significantly ($p > 0.05$) of the sixth month in the twelfth month of treatment (2.2%, 6.7% and 2.2% respectively D0, M6 and M12). Normochromic microcytic anaemia meanwhile, decreased insignificantly from initiation to six months and increased insignificantly in the twelfth month of treatment (2.2%, 0 % and 2.2% respectively D0, M6 and M12). In the same B class, the prevalence of normochromic normocytic anaemia (4.4 % 4.4 % and 2.2% respectively D0, M6 and M12) and hypochromic normocytic anaemia (2.2%, 0% and 2.2%, respectively D0, M6 and M12) suffered no variation of initiation in the sixth month and decreased insignificantly the sixth month in the twelfth month of treatment. The same observations were made for the prevalence of hypochromic normocytic anaemia to C class. As against to the B class, the prevalence of hypochromic macrocytic anaemia decreased significantly ($p < 0.05$) from initiation to sixth month and significantly increased ($p < 0.05$) from sixth to twelfth month of treatment (8.9%, 0% and 8.9% respectively D0, M6 and M12).

Components of abnormalities leukocyte and thrombocytes parameters according to HIV infection progression

The different proportions of abnormal leukocyte and thrombocytes parameters, according to CD4 classes of 12 months of treatment are reported in table VI. Assessment of these parameters in this table revealed that no significant difference ($p > 0.05$) was observed between the prevalence of leukopenia, neutropenia and lymphocytosis to A and B classes, and of monocytosis and thrombocytopenia for all CD4 classes. By cons, a significant difference ($p < 0.05$) for the prevalence of leukopenia, neutropenia and lymphocytosis to C class has been shown. In this C class, the prevalence of leukopenia decreased significantly ($p < 0.05$) from initiation to the twelfth month of treatment (22.2%, 11.3% and 8.9% respectively D0, M6 and M12). As for the lymphocytosis, it was absent in the sixth month of treatment before reappear in 6.7% of our patients in the twelfth month. The study results also showed that the overall high prevalence of leukopenia to B and C classes for initiation of neutropenia and lymphocytosis to A and B classes and all monocytosis classes were observed during follow-up. However, a low frequency thrombocytopenia throughout the follow-up as CD4 classes has been reported (Table 6).

Table 5: Anaemia types and HIV infection progression

Anaemia types		D0	M6	M12	P values
		n %	n %	n %	
Hypochromic Microcytic Anaemia		9 20	8 17.8	9 20	0.5 (NS)
Normochromic Microcytic Anaemia		1 2.2	0 0	1 2.2	0.09 (NS)
Normochromic Normocytic Anaemia		4 8.9	2 4.4	1 2.2	0.09 (NS)
Hypochromic Normocytic Anaemia		1 2.2	2 4.4	0 0	0.04 (S)
Normochromic Macrocytic Anaemia		1 2.2	2 4.4	0 0	0.04 (S)
Normochromic Microcytic Anaemia		6 13.3	6 13.3	9 20	0.2 (NS)
	HIV infection progression				
Hypochromic Microcytic Anaemia	A	5 11.1	5 11.1	5 11.1	0.7 (NS)
	B	1 2.2	3 6.7	1 2.2	0.2 (NS)
	C	3 6.7	0 0	3 6.7	0.004 (S)
Normochromic Microcytic Anaemia	A	- -	- -	- -	
	B	1 2.2	0 0	1 2.2	0.2 (NS)
	C	- -	- -	- -	
Normochromic Normocytic Anaemia	A	1 2.2	0 0	0 0	0.08 (NS)
	B	2 4.4	2 4.4	1 2.2	0.6 (NS)
	C	- -	- -	- -	
Hypochromic Normocytic Anaemia	A	- -	- -	- -	
	B	1 2.2	1 2.2	0 0	0.2 (NS)
	C	1 2.2	1 2.2	0 0	0.2 (NS)
Normochromic Macrocytic Anaemia	A	0 0	1 2.2	0 0	0.2 (NS)
	B	- -	- -	- -	
	C	1 2.2	0 0	0 0	0.2 (NS)
Normochromic Microcytic Anaemia	A	1 2.2	2 4.4	4 8.9	0.09 (NS)
	B	4 8.9	0 0	4 8.9	0.0006 (S)
	C	0 0	1 2.2	1 2.2	0.2 (NS)

D0: Day of antiretroviral therapy starting, M6: Month 6 of antiretroviral therapy, M12: Month 12 of antiretroviral therapy, Stage A: CD4 ≥ 500, Stage B: CD4 Between 200-499, Stage C: CD4 < 200, n: Observed subjects' number in each group, S: Statistically different for p value <0.05; NS: Not statistically significant for p value >0.05

Table 6: HIV infection progression and changes in leukocyte and thrombocyte parameters

Abnormal leukocytes and thrombocytes parameters	HIV infection progression	D0	M6	M12	p values
		n %	n %	n %	
Leucopenia	A	3 6.7	3 6.7	3 6.7	0.8 (NS)
	B	5 11.1	8 17.8	6 13.3	0.3 (NS)
	C	10 22.2	5 11.3	4 8.9	0.02 (S)
Neutropenia	A	10 22.2	9 20	12 26.7	0.3 (NS)
	B	9 20	7 15.6	10 22.7	0.3 (NS)
	C	6 13.3	1 2.2	2 4.4	0.005 (S)
Lymphocytose	A	14 31.1	13 28.9	17 37.8	0.2 (NS)
	B	14 31.1	12 26.7	13 28.9	0.6 (NS)
	C	5 11.1	0 0	3 6.7	0.0004 (S)
Monocytose	A	8 17.8	6 13.3	9 20	0.3 (NS)
	B	9 20	14 31.1	11 24.4	0.1 (NS)
	C	8 17.8	5 11.1	6 13.3	0.3 (NS)
Thrombopenia	A	- -	1 2.2	1 2.2	0.2 (NS)
	B	3 6.6	3 6.6	2 4.4	0.6 (NS)
	C	2 4.4	1 2.2	1 2.2	0.5 (NS)

D0: Day of antiretroviral therapy starting, M6: Month 6 of antiretroviral therapy, M12: Month 12 of antiretroviral therapy, Stage A: CD4 ≥ 500, Stage B: CD4 Between 200-499, Stage C: CD4 < 200, n: Observed subjects' number in each group, S: Statistically different for p value <0.05, NS: Not statistically significant for p value >0.05

DISCUSSION

Biological monitoring of population living with HIV represents a very important part in their care. It allows to assess the effectiveness of treatment regimens and abnormal blood test results related to it [4, 5, 6]. To verify this fact, a study on changes in blood parameters of 45 subjects living with HIV in Integrated Centre for Bioclinical Research of Abidjan was conducted. The mean age of patients was 26.1 ± 0.7 years ranging from 18 to 45 years. This result is lower than those described by Nadembaega *et al*., [11] and Kazadi *et al*., [12] observed that the average of the respective ages of 35.87 ± 7.55 years and 37.65 ± 8.91 years. In this study, 60% of subjects are women against 40% men. These same findings have been reported by Mouhari Touré *et al*., [13] and Tovi et *al*., [14] who observed respectively percentages of female patients of 68.6% and 65.1%. According to USAID [15], this female proportion is due to a natural anatomical predisposition of women to the risk of HIV transmission and the fact that they attended more health facilities. In addition, HIV-1 was the most rate with 91.1%. This prevalence is similar to Mouhari Touré *et al*., [13]. They observed 97.5% of HIV-1.

In this study, blood laboratory tests was performed in these 45 patients at initiation, the sixth and twelfth months of antiretroviral therapy.

The study results reveal that no significant reduction in anaemia rate during follow-up is observed. This prevalence is 51.1% at initial balance sheet, increased to 42.2% in sixth and 40% in the twelfth month of treatment. Our results are not identical to those obtained by Nacoulma *et al*., [16]. According to the work of these authors, a significant decrease in hemoglobin in patients on triple therapy after six months was observed. Indeed, the reduction in the prevalence of anaemia in our study could be explained to the effectiveness of antiretroviral therapy [17, 18]. Moreover, in the context of HIV infection, chronic inflammation, micronutrient deficiency and

opportunistic infections are also the basis of the anaemia observed in our subjects [12].

For our work, according to the red cell indices, six types of anaemia are observed. Among these six types, hypochromic microcytic anaemia and hypochromic macrocytic anaemia are the most common. These results are objected to those reported by Diallo *et al*., [19], which meant that normochromic normocytic anaemia was most frequent during their study. However, Kazadi *et al*., [12]. who studied the haematologic abnormalities during antiretroviral treatment in infected population, were indicated the most common type of anaemia is hypochromic microcytic anaemia (59.3%), followed by normochromic normocytic anaemia (39.5%) and normochromic macrocytic anaemia (1.2%). These prevalences of hypochromic microcytic anaemia and normochromic normocytic anaemia observed by Kazadi *et al*., [12] are very high (20%, 17.8% and 20 % respectively at D0, M6 and M12) compared to those observed in our study (8.9%, 4.4% and 2.2% respectively at D0, M6 and M12). But a similar results with prevalence normochromic macrocytic anaemia are observed.

Observed microcytic hypochromic anaemia in our study could be explained by the fact that HIV would lead to sequestration of some elements of synthesis of red blood cells, including iron by macrophages during infection. This would result in a formation of hemoglobin deficiency [20]. Furthermore, according to investigations carried out by Bléyéré *et al*., [21] observing the normochromic normocytic anaemia, hypochromic normocytic anaemia or even normochromic microcytic anaemia is due to changes in iron stores by HIV infection. However, progression HIV infection characterized by the CD4 count in our subjects is associated with high rates of hypochromic microcytic anaemia and hypochromic macrocytic anaemia compared to other observations.

Given these CD4 count, this study shows a no significant 6.7% increase in prevalence of CD4 count at six months compared to mean rate of initiation (40% and 46.7%) and sixth month in twelfth month that rate to decline insignificantly by 4.5% (46.7% and 42.2% respectively).

The increase in CD4 cell count observed in our study is lower than the rates achieved by some authors. Indeed, Van Dijk *et al*., [22] and Okomo *et al*., [23] respectively reported an increase of 13% and 10.3% of the CD4 count. This increase in CD4 count in our study may be due firstly to the properties of antiretroviral to restore immunity and also for good decision antiretroviral therapy.

Our investigations also reveal in this study, a high prevalence of neutropenia and leucopenia throughout follow-up. Some authors have reported that the prevalence of neutropenia during antiretroviral therapy increases before falling after six months [16, 24]. This is in line with our results because the prevalence of neutropenia, which is 55.6% at starting of treatment increased to 37.8% in the sixth month. These prevalences are higher than that reported by Kazadi *et al*., [12]. According to the work done by these authors in Lubumbashi (DR Congo), neutropenia prevalence was 10.4%. The neutropenia was due to cotrimoxazole [25]. Furthermore, studies conducted by Babadoko *et al*., [26] in HIV-positive patients on treatment reported that neutropenia may occur in all classes of HIV infection during follow-up. These same observations are reported in our investigations. According to these authors, neutropenia could be due to damage of the production and / or increase the destruction of leukocytes.

Unlike the prevalence of neutropenia, lymphopenia is observed only in 2.2% of our subjects at the beginning. It suggests that antiretroviral treatment is effective.

As for thrombocytopenia, it is observed in 11.1% of patients at initiation of treatment, 11.1% and 8.9% in six and twelve months of treatment. Our results corroborate those of Erhabor *et al*., [27] in Nigeria with 10% of cases of thrombocytopenia. Moreover, several anomalies in varying degrees according to leukocyte parameters CD4 classes are observed. There are monocytosis and lymphocytosis. These same observations were indicated by Kazadi *et al*., [12].

In biochemical parameters, majority of patients have normal glucose levels (93.4%, 95.6% and 97.8% respectively at D0, M6 and M12), creatinine of (73.3%, 71, 1% and 84.4% respectively at D0, M6 and M12) and ALT (88.9%, 84.4% and 82.2% respectively at D0, M6 and M12). These different rates of biochemical parameters are similar to those obtained by Mahamadou [28] in Mali.

However, the proportion of patients with their ALT levels above normal at initial assessment not significantly increased. These results translate into liver failure caused by combined use of antiretrovirals [29].

In contrast to our study, Mahamadou [28] in his work mentioned a decrease in ALT levels in these patients. Similarly, the prevalence of creatinine are abnormally high at 6.7% of our patients at D0 and M6. But, in the twelfth month of treatment no patient had an unusually high creatinine. These prevalence of 6.7% observed could be explained by poor compliance, by not applying the prescribed rules of the physician and the toxic effects of some antiretroviral [9].

CONCLUSION

The followed up study of blood parameters in population living with HIV helps to highlight changes in blood parameters. Regarding the haematological parameters, the prevalence of anaemia during follow-up decreases. Among the anaemia types, hypochromic microcytic anaemia and hypochromic macrocytic anaemia are the most common. According to CD4 classes, these two types of anaemia are also the most common. At the level of leukocyte parameters, the majority of patients have normal levels. Several causes of these parameters according to CD4 classes are observed to varying degrees. It is the same for the platelet count. For biochemical parameters, most of our subjects have normal levels throughout follow-up. These blood parameters as a whole were increased for most. This increase would be due to the effectiveness of antiretroviral therapy and better patient monitoring at ICRBA.

This work should be continued by identifying the different regimens and their effects on the blood parameters of patients on antiretroviral therapy during follow-up.

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