World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Evaluation of the care of patients living with HIV/AIDS under antiretroviral treatment at the Matam Communal Medical Center in Conakry (2021-2023)

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World Journal of Advanced Research and Reviews, 2025, 25(01), 1058-1071

Publication history: Received on 03 December 2024; revised on 12 January 2025; accepted on 14 January 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.25.1.0109

Abstract

Introduction: Biological and therapeutic monitoring of patients living with HIV (PLHIV) are important, particularly in areas where morbidity and mortality are high.

Objective: To assess the current situation of care and the hematological profile of PLHIV on antiretroviral treatment at the Matam Communal Medical Center.

Material and Methods: Two years' prospective study, October 1st, 2021 to October 31st, 2023.

Results: A total of 203 patients were studied. females were predominant (67.49%) with a sex ratio = 2.07. The majority of patients were in the 21-40 age group (44.82%), followed by 41-60 years (39.90%). The average age of the patients was 39 years with extremes of 18 and 76 years. Singles represented 65.02%, followed by divorced (19.21%) and married (15.27%). On the socio-professional level, housewives were the majority (33.49%), followed by workers (30.04%), and sales agents (23.64%). Amongst the 81 patients tested to their viral load, 70% had a detectable viral load. Immunodeficiency was generally advanced. The majority of patients had a LTCD4+ rate below 200Cells/µl. The mean LTCD4+ level was 124.52 cells/µl with a range of 5 to 349 cells/µl. Out of 203 PLHIV, 53% had a low hemoglobin level (mean 9.86g/dl). Out of 107 PLHIV/AIDS, the different types of anemia were observed: microcytic anemia (20.56%), normocytic anemia (79.43%), hypochromic anemia (30.84%), low hematocrit (71%), low leukocyte count (65.42%), low neutrophil count (40.18%), lymphocytes (60.74%), monocytes (54.20%), platelets (31.77%).

Conclusion: Viral load and hematological profile of PLHIV/AIDS were determined to improve the management PLHIV, and to avoid antiviral therapeutic failures.

Keywords: Evaluation; PLHIV/AIDS; CD4; Hematology; Conakry/Guinea

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1. Introduction

Human Immunodeficiency Virus (HIV) is a retrovirus belonging to the genus *Lentivirus*, family *Retroviridae*. It is a virus responsible for a chronic infection targeting white blood cells, particularly CD4 lymphocytes (LTCD4), resulting in a progressive deficit of the body's immune system leading to acquired immunodeficiency syndrome (AIDS) [1-3].

People infected with HIV are becoming increasingly susceptible to contracting certain opportunistic diseases such as toxoplasmosis and tuberculosis, and certain forms of cancer [1,4].

The human immunodeficiency virus is the etiological agent responsible for acquired immunodeficiency syndrome (AIDS). It is transmitted through bodily fluids of an infected person including blood, semen and vaginal secretions during sexual contact, infected blood products, by prenatal infection of the fetus, or by perinatal or postnatal infection of the newborn [5].

The prevalence of HIV/AIDS remains a major challenge for public health. Indeed, recent data from WHO/AIDS show rather increasing statistics. Indeed, in 2024 these data show that in 2023, 39.9 million [36.1 million to 44.6 million] people worldwide were living with HIV. The number of people newly infected with HIV in 2023 was 1.3 million [1 million to 1.7 million] and that 630,000 [500,000–820,000] people died of AIDS-related illnesses in 2023. However, 30.7 million people [27 to 31.9 million] had access to antiretroviral treatment in 2023 [6,7].

On the other hand, the same report estimates that 88.4 million [71.3 million-112.8 million] people have been infected with HIV since the beginning of the epidemic, and that 42.3 million [35.7 million to 51.1 million] people have died of AIDS-related illnesses since the beginning of the epidemic [5].

Sub-Saharan Africa bears the brunt of the epidemic. Although the introduction of antiretroviral drug therapy (ART) has significantly reduced morbidity and mortality in North America and Western Europe, there is a treatment gap in developing countries. Already in 2017, the UNAIDS Program report showed that nearly 36,900,000 PLHIV, including 940,000 deaths and 1,800,000 new infections worldwide in 2017 [5].

According to the UNAIDS Program report, nearly 36,900,000 PLHIV, including 940,000 deaths and 1,800,000 new infections worldwide in 2017 [5].. As one of the chronic diseases, AIDS seriously affects public health worldwide. And the mortality caused by AIDS is significantly higher than other sexually transmitted diseases [8].

In patients infected with human immunodeficiency virus (HIV), malnutrition is associated with an increased risk of death and studies in industrialized countries have demonstrated that weight loss is a good predictor of opportunistic infection and death [9]. Similar results have been reported in developing countries, including in patients on highly active antiretroviral therapy [10]. For the World Health Organization (WHO), the comprehensive care of PLHIV must include nutritional support [11].

The extraordinary progression of antiretroviral treatment since 2010 in many of the world's most affected countries has reduced the number of AIDS deaths from 1.5 million in 2010 (1.3 million-1.7 million) to 1.1 million (940,000-1.3 million) in 2015. Global coverage of antiretroviral treatment reached 46% (43-50%) by the end of 2015 [5].

Gains have been greatest in the world’s most affected region, Southern and Eastern Africa, where coverage increased from 24% (22-25%) in 2010 to 54% (50-58%) in 2015, reaching a total of 10.3 million people [5].

The early initiation of antiretroviral therapy reduced rates of sexual transmission of HIV-1 and clinical events, indicating both personal and public health benefits from such therapy [12].

The UNAIDS report on the global AIDS epidemic in 2015 indicates that the prevalence of HIV infection in the adult population in Guinea, Mali, Côte d’Ivoire, Benin, Niger, Ghana and Togo were 1.6%; 1.1%; 3%; 1%; 0.5%; 1.7%; 2.3% respectively in 2014 [5].

The biological assessment constitutes the real-time witness on the one hand of the efficacy and tolerance of the treatment and on the other hand of the evolution of the infection. In the Republic of Guinea, patients under ARV treatment are confronted on the one hand with a problem of biological monitoring and on the other hand with a frequent shortage of reagents and the abandonment of treatment.

- What is the current situation of the care of people living with HIV under antiretroviral treatment in the city of Conakry?
- What is the hematological profile of PLHIV under antiretroviral treatment at the Matam CMC in Conakry?

To answer these questions, taking into account these difficulties in the care of PLHIV and our desire to actively participate in the fight against HIV/AIDS by improving the health care of patients, we have chosen to address the theme entitled: Evaluation of the care of patients living with HIV under antiretroviral treatment in achieving objectives 3-90 at the Matam Communal Medical Center (2021-2023).

For the implementation of the work, we have set ourselves the following objectives:

1.1. General objective

To assess the current situation of care and the hematological profile of patients living with HIV under antiretroviral treatment at the Matam Communal Medical Center with a view to improving their care.

2. Material and methods

2.1. Study Framework

This is a study conducted at the laboratory of the Belgian Doctors Without Borders (MSF/B) project at the Matam Communal Medical Center. The main laboratory of the project is located at the Matam CMC and is divided into three (3) units including the HIV Unit, the GeneXpert Unit and the Biocentric Unit (viral load).

2.2. Bio material

Bloods from patients referred by the Health Centers (focal points) for their care.

2.3. Type and duration of study

This is a prospective and descriptive cross-sectional study lasting 2 years, from October 1, 2021 to October 31, 2023.

2.4. Study population

Our study focused on all patients living with HIV/AIDS on ARV treatment in the Matam Communal Medical Center on behalf of Médecins sans frontières (MSF/B) during the period of our study.

2.5. Sampling

The sampling was exhaustive and concerned all patients living with HIV/AIDS (PLWHA/AIDS) on antiretroviral (ARV) treatment at the Matam Communal Medical Center during the period of our study.

2.6. Admission or selection criteria

- **Inclusion criteria:** All HIV/AIDS patients on ARVs at the Matam CMC on behalf of MSF/Belgium, who agreed to submit to our study and agreed to respect the treatment monitoring schedule during the study period, were included in the study.
- **Non-inclusion criteria:** All patients living with HIV/AIDS who are not in the HIV/AIDS care program on behalf of MSF/Belgium and outpatients were not included in this study.

2.7. Epidemiological variables

Epidemiological variables were divided into quantitative and qualitative variables. The quantitative variables were: Frequency and age.

2.8. Qualitative variables

Quantitative variables were: Sex, Profession, Residence (or origin).

2.9. Biological variables

-Xpert® HIV-1 Viral LoadMSFB/REF, Viral load, CD4, Hemoglobin level (THB), Mean corpuscular volume of red blood cells (MCV), Mean corpuscular concentration of red blood cells (MCC), MCC, Complete blood count (CBC).

2.10. Operational variables

- **Samples:** Blood samples were collected by venous sampling. For each patient, the venous sample was placed in EDTA tubes for immuno-hematological tests (CBC, viremia, and CD4 count).

It should be noted that the amount of blood collected was 5ml in order to allow a test to be repeated if necessary, particularly in the event of an error.

2.10.1. Viral load

Determination of viral load corresponding to the detection and quantification of HIV type 1 RNA in patient plasma was performed by GeneXpert HIV-1 test. This is an in vitro reverse transcription polymerase chain reaction (RT-PCR) test. Venous blood samples are collected from PLWHA/AIDS patients.

The test can quantify HIV-1 RNA in the range of 40 to 10,000,000 copies/ml. The GeneXpert HIV-1 VL test is validated for the quantification of HIV-1 RNA of group M (subtypes A, B, C, D, F, G, H, J, K, CRF01_AE, CRF02_AG and CRF03_AB) and groups N and O.

GeneXpert instrument systems automate and integrate sample preparation, nucleic acid extraction and amplification, and target sequence detection in simple or complex samples by real-time PCR and reverse transcriptase (RT-PCR). The systems consist of an instrument, a personal computer, and preinstalled software for running tests and displaying results. The systems require single-use, disposable GeneXpert cartridges that contain RT-PCR reagents and house the sample extraction and RT-PCR processes. Because the cartridges are closed, cross-contamination between samples is minimized. For a complete description of the systems, see the GeneXpert Dx User Manual or the appropriate GeneXpert Infinity User Manual. GeneXpert HIV-1 Viral Load1 .301-3068-EN, Rev. L June 2020) [14].

The HIV-1 VL test includes reagents for the detection of HIV-1 RNA in samples and two internal controls used for the quantification of HIV-1 RNA. Internal controls are also used to monitor the presence of inhibitors during RT and PCR reactions.

The probe verification control (PVC) consists of checking the reagent rehydration, the filling of PCR tubes in the cartridge, the integrity of the probe and the stability of the fluorochrome (GeneXpert HIV-1 Viral Load: 1301-3068-EN, Rev. L June 2022) GeneXpert HIV-1 VL: Undetectable (<40 copies/ml); Undetectable (<1.6 log copies/ml) [**14**].

2.10.2. Haematology Analysers

Patient haematological parameters were determined using Practical Guide for Laboratory Technicians in Resource-Limited Settings. Edition 2018 Médecins Sans Frontières; Diagnostic Network, Plantage Middenlaan 141018 DD Amsterdam Netherlands [14].

- CD4: CD4 counts were performed using the BD FACS Presto Near-patient CD4 counter. The BD FACS Presto Near-patient CD4 counter is an automated system, designed for in vitro diagnostic use, for the direct measurement of absolute CD4 counts, percentage of CD4 cells in lymphocytes and haemoglobin concentration in human whole blood.

Absolute CD4 counts and percentages (%CD4) were used to assess the immune status of patients with or suspected of having immunodeficiency.

Since CD4 antigen is the receptor for HIV, the absolute value and percentage of CD4 T cells are the cellular parameters most closely associated with clinical prognosis and HIV progression. The number of CD4 T cells decreases in HIV infection.

In addition, hemoglobin is a protein in red blood cells that carries oxygen from the lungs to the body. Thus, a decrease in hemoglobin levels is an indicator of anemia. This anemia is a hematologic abnormality frequently associated with HIV infection.

The BD FACS Presto cartridge, the CD4 /% CD4/Hb cartridge, contains reagents BD FACS Presto cartridge (USA).

The BD FACSPresto cartridge kit is designed for the application of venous and capillary whole blood to the finger. The BD FACSPresto CD4/Hb cartridge is a single-use reagent cartridge for use with the BD FACSPresto™ system to perform

direct quantitation and enumeration of absolute CD4 counts, CD4 percentage of lymphocytes, and determination of hemoglobin concentration in normal and HIV-positive patients, in conjunction with other laboratory and clinical findings.

2.11. Ethical consideration

Before any questionnaire was administered, informed consent was obtained from each participant and anonymity was respected.

3. Results

The application of the research methodology resulted in the following results presented in the form of tables, figures and graphs which were interpreted, commented and discussed according to the data from the available literature.

3.1. Distribution of PLHIV on ARV treatment according to epidemiological parameters

Table 1 Socio-demographic characteristics of PLHIV

Communes	**Effectifs**	**Pourcentages**
Matoto	38	18.71
Matam	36	17.73
Dixinn	12	5.91
Kaloum	11	5.41
Hors Conakry	72	35.46
Total	203	100
Socio-professional characteristics	**Number**	**Percentage (%)**
Housewives	68	33.49
Workers	61	30.04
Commercial agents	48	23.64
Administration agents	2	0.98
Security guards	8	3.94
Health workers	2	0.98
Teachers	2	0.98
Students/Pupils	6	2.95
Unemployed	6	2.95
Total	203	100
Age groups (years)	**Number**	**Percentage**
≤ 20	16	7.88
21-40	91	44.82
41-60	81	39.90
≥ 61	15	7.39
Total	203	100
Marital status	**Number**	**Percentage**
Singles	132	65,02
Divorced	39	19,21

Married	31	15,27
Widow	1	0,50
Total	203	100
Sexe	**Number**	**Percentage**
Female	137	67.49
Male	66	32.51
Total	203	100

Average age=39 years, extremes: 18 and 76 years; Sex-ratio (F/M)=2.07

3.2. Determination of biological parameters in HIV/AIDS patients receiving ARV treatment

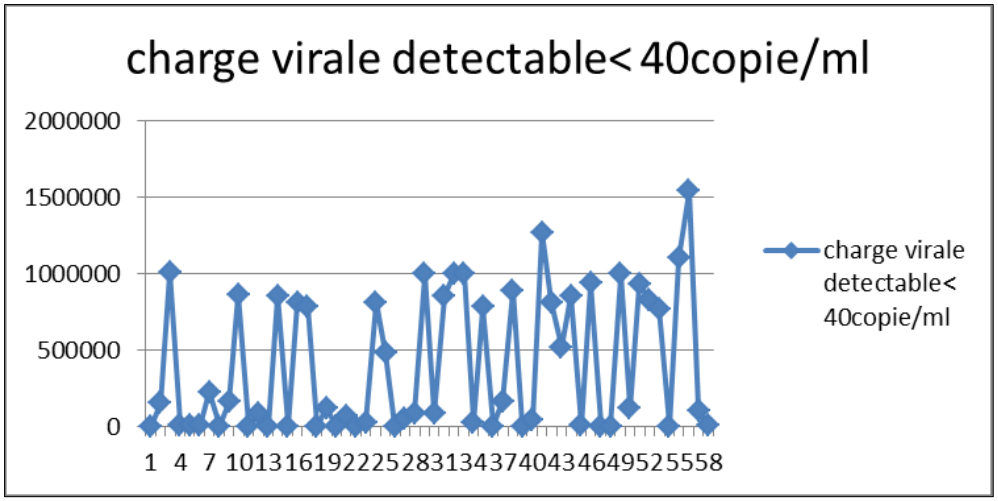

Figure 1 Determination of HIV/AIDS viral load and CD4 in patients on ARV treatment

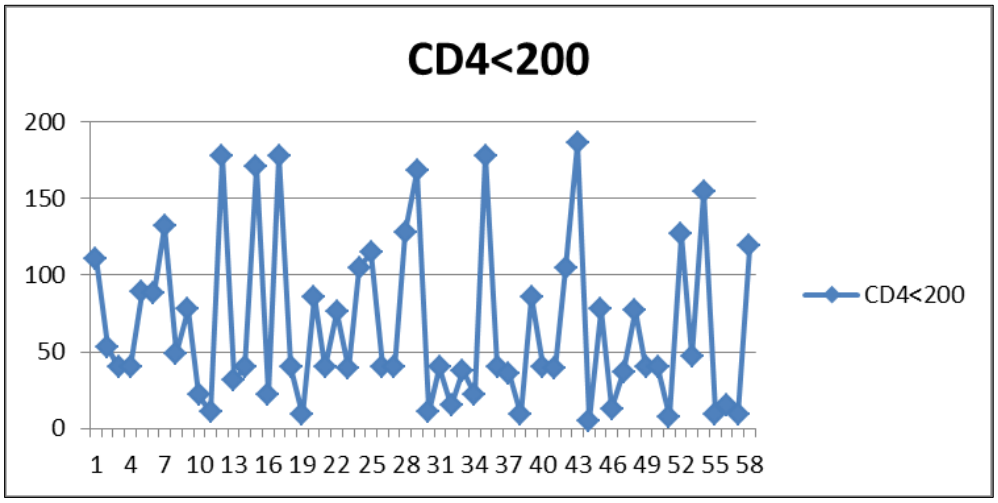

Figure 2 Distribution of HIV/AIDS patients with detectable viral load according to the LTCD4+ rate

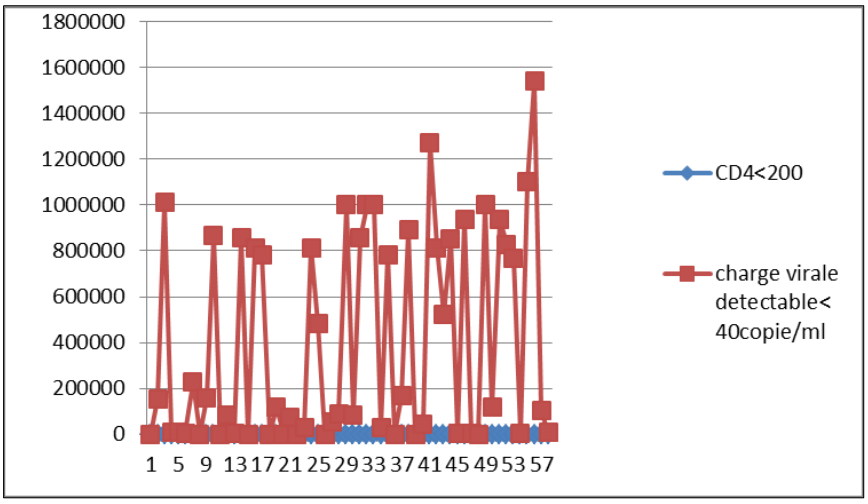

Figure 3 Variation in CD4 count and viral load in PLHIV

Table 2 Pathophysiological variations of hematological parameters in PLHIV under antiretroviral treatment

Total		**Hemoglobin level in PLHIV**					
		Low level		Normal level		High level	
Number	%	Number	%	Number	%	Number	%
203	100	107	52.70	96	47.29	00	00
Typology of anemia in PLHIV							
Total		Rough		Moderate		Severe	
Number	%	Number	%	Number	%	Number	%
107	100	31	28.97	46	42.99	30	28.03
Pathophysiological variation of the mean corpuscular volume of red blood cells (MCV) in PLHIV							
Total		Microcytic values (MCV< 80 fl)		Normocytic values (100<MCV>80 fl)		Macrocytic values (MCV>100 fl)	
Number	%	Number	%	Number	%	Number	%
107	100	22	20.56	85	79.43	00	00
Pathophysiological variation of MCHC in PLHIV							
Total		Hypochromic values (CCMH < 32)		Normochromic values (32<CCMH<36)		Hyperchromic values (CCMH = 36)	
Number	%	Number	%	Number	%	Number	%
107	100	33	30.84	71	66.35	3	2.28
Pathophysiological variation of hematocrit values in PLHIV							
Total		Hematocrit (Hte) values					
		Low Hte< 33,3 %		Normal Hte (33,3-8,3%)		High Hte> 38,3%	
Number	%	Number	%	Number	%	Number	%
Pathophysiological variation of leukocyteWhite blood cells (WBC) values in PLHIV							
Total		White blood cells (WBC) values					

		Low WBC<6,7		Normal WBC (6,7-7,95)		High WBC>7,95	
Number	%	Number	%	Number	%	Number	%
107	100	70	65.42	7	6.54	30	28.03
Pathophysiological variations of neutrophil values in PLHIV							
Total		Neutrophil values					
		Low Neutrophil values (< 55.1%)		Normal eutrophils values (55,1-63,5) %		High Neutrophil values (>63,5%)	
Number	%	Number	%	Number	%	Number	%
107	100	43	40.18	7	6.54	57	53.27
Pathophysiological variation of Lymphocyte values in PLHIV							
Total		Low Lymphocyte Values (<28%)		Normal Lymphocyte values (28-32%)		High Lymphocyte values (> 35 %)	
Number	%	Number	%	Number	%	Number	%
107	100	65	60.74	7	6.54	35	32.71
Pathophysiological variation of monocyte values in PLHIV							
Total		Monocyte Values					
		Low monocyte values (<7.9%)		Normal Monocyte values (7.9-13.3)%		High Monocyte Values (>13.3%)	
Number	%	Number	%	Number	%	Number	%
107	100	58	54.20	41	38.31	8	7.47
Pathophysiological variation of platelet values in PLHIV							
Total		Platelet values					
		Low platelet values <195x10^3/µl		Normal platelet values (195-263) 10^3 /µl		High platelet values >263x10^3 /µl	
Number	%	Number	%	Number	%	Number	%
107	100	34	31.77	25	23.36	48	44.85

4. Discussion

4.1. Demographic characteristics of PLHIV under ARV treatment.

Table 1 shows that most of the patients come from other municipalities outside the Conakry and Matoto areas, i.e. 35.46% and 17.73% respectively.

These results could be justified by the accessibility to health facilities and non-acceptance of test results followed by doctors' instructions.

Which explains a high rate of patients at the Reference and Diagnostic Hospitalization Center at the CMC of Matam. In addition, the demographic concentration and the (precarious) living conditions in the study area also reflect this high proportion in two municipalities compared to those of Kaloum. These rates were 5.41% for Kaloum, 17.73% for Matam, 5.91% for Dixinn. The majority of studies carried out in Africa show that HIV infection affects the most disadvantaged populations. These populations, with little or no education, are less affected by awareness messages. The vulnerability to HIV of this segment of the population could also be explained by poverty and insufficient socio-economic infrastructure. This same trend was reported by Niang I in 2017 with 69.52% living in rural areas and 60% unemployed in the department of Oussouye, by Kamala A, in 2016 who found 63.29% patients living in rural areas and 87.92% unemployed in the department of Sédhiou and by Tamba T who reported that 80.30% lived in rural areas and 82% were

unemployed in the department of Bignona in Senegal in 2013 [14-16]. This rural predominance underlines the importance of decentralizing the monitoring of PLHIV, with delegation of tasks to local structures such as health posts.

Table 2 shows that of the 203 positive patients, 67.49% were female versus 32.59% male with a sex ratio of 2.07. Identical results were found in several African countries. Thus, Saka B in Togo, found in his study a female predominance with 72.9% and a sex ratio (F/M) of 2.5 [17]. These data suggest that African women would be at least 2.5 times more exposed to contracting HIV than their male counterparts.

Furthermore, through Table 1, we observe that Housewives were the most affected, i.e. 33% followed by workers (30%). The same observation was made by Abay et al, (2018), in Ethiopia, who reported a predominance of Workers with 32%, followed by Housewives (19%) [18]. Through the two studies, we can affirm that Housewives and Workers belong to a vulnerable group less affected by the awareness methods applied in Africa [19]. In our study population, the majority of the cohort (126 patients) or 62% (n=203) of cases were female with a sex ratio (F/M) of 2.07. The feminization of the epidemic could be explained by the fact that transmission is essentially heterosexual in Africa with a vulnerability of the female gender on several levels.

Anatomically, the vaginal mucosa is more extensive than that of men, and the period of contact with secretions containing HIV is longer. This situation thus indicates the biological vulnerability of women compared to men.

Furthermore, the viral load of infected sperm is higher than that of the sexual secretions of an infected woman. As a result, the risk of HIV transmission during unprotected sexual intercourse is up to two to four times higher in women than in men. Added to this is the frequency of microtraumas, especially in young women, secondary to rough sexual intercourse, and genital mutilation, sexually transmitted infections associated with immaturity of the genital tract which would contribute to increasing the risk of transmission.

On the sociocultural level, traditional practices such as polygamy, levirate, sororate, early marriages, but also the low decision-making power given to women in homes [20] Economically, women are often dependent on their spouses and men in general. This situation can lead them to take risks in order to meet their needs.

Furthermore, through Table 1, we observe that Housewives were the most affected, i.e. 33% followed by workers (30%). The same observation was made by Abay et al, in 2018, in Ethiopia, who reported a predominance of Workers with 32%, followed by Housewives (19%) [18]. Through the two studies, we can affirm that Housewives and Workers belong to a vulnerable group less affected by the awareness methods applied in Africa.

The most represented age group was between 21 and 40 years, or 45% followed by that of 41 to 60 years, or 40% with an average age of 39 years and extremes of 18 and 76 years. These results show a strong dispersion of the average ages so these values are heterogeneous.

Furthermore, it is deplorable to note that this age group called active and constituting the most solid workforce of society is the most represented in our studies. It also explains the age of intense virility hence the high rate of sexual transmission of HIV.

Our results are comparable to those of Manga MA. who had found an average age of 44.4 ± 12.5 years at the Silence health center in Ziguinchor in 2015 [21].

The most represented age group was between 21 and 40 years, or 45% followed by that of 41 to 60 years, or 40% with an average age of 39 years and extremes of 18 and 76 years. These results show a strong dispersion of the average ages so these values are heterogeneous.

Furthermore, it is deplorable to note that this age group called active and constituting the most solid workforce of society is the most represented in our studies. It also explains the age of intense virility hence the high rate of sexual transmission of HIV.

On the other hand, the results of this present work are partly close to those found by Karfo et al, (2014) who reported that the average age of their patients was 44 years with extremes of 16 and 81 years [22]. The age group between 45-54 years was the most representative with (39.4%).

During our study, Singles were the most infected, i.e. 65.02% followed by Divorced and Married people i.e. 19.21% and 15.27% respectively. This result is consistent with that achieved by Kéita et al. at the Ignace Deen University Hospital

in 2014 [23] who found 67% of singles and 33% of married people. These results could be explained by the fact that stable couples drag their feet when going to HIV testing facilities fearing losing their home and being stigmatized in society. It is also necessary to emphasize the non-sharing of information on HIV status among people in a relationship and prevention within sero-discordant couples. Indeed, Seydi I M. et al., had found in their study that 92% of patients had not informed their spouse of their HIV status. This justifies the need to carry out HIV screening during premarital check-ups or prenatal consultations [20]. In contrast, the results of this present work are different from those reported by Karfo et al in 2014, who found that the majority of their patients were married (52.1%), while 62.05% of patients in our study were single [20].

4.2. Determination of biological parameters in HIV/AIDS patients receiving ARV treatment

4.2.1. Determination of HIV/AIDS viral load and CD4 in patients on ARV treatment

Among the 203 patients (Figure 1) who tested positive, only 81 patients were taken into account according to their viral load. The statistical analysis therefore only concerned, on a sample of 81 respondents to the (Undetectable Support Program = Non-Transmissible) 70% of patients had a detectable viral load (CV≤40 copies/ml) with an average of (59277 copies/ml) against 30% of patients with an undetectable viral load. No difference was found between the 116 patients under treatment and the 81 patients in whom the viral load is detectable. Opie et al., (2016) reported in South Africa that The prevalence of cytopenias, particularly anemia, increases in advanced staes of HIV with lower CD4+ T-cell counts, and is ameliorated by ART [25-28]. Anemia is the most common cytopenia, with a median prevalence of 30% in ART-naive PWH in sub-Saharan Africa [27]. The prevalence of thrombocytopenia

and neutropenia in PLHIV in the South Africa setting is reported at 12.1% and 21.6%, respectively [29]. Advanced HIV/AIDS, defined as a CD4+ T-cell count <200 cells/µL, is a common cause of pancytopenia even in the absence of coexistin patholoy [30]. Morpholoical dysplasia of 1 or more cell lines seen on the blood smear and bone marrow (BM) is a frequent findin in advanced HIV disease and is associated with cytopenias [31]. An approach to the differential dianosis of cytopenias in PLHIV.

4.2.2. Distribution of HIV/AIDS patients with detectable viral load according to the LTCD4+ rate

This figure 2 shows that out of 203 HIV/AIDS positive patients on antiretroviral treatment hospitalized at the CMC Matam; 81 patients were taken into account according to their viral load. Immunodepression was generally advanced, the majority of patients in our study had a LTCD4+ rate of less than 200Cell/µl. The average LTCD4+ rate was 124.52 cells/µl with extremes ranging from 5 to 349 Cells/µl. Patients with an average LTCD4+ rate ≥ 200cells/µl represented 70% of cases (n=81). Studies conducted in Senegal had found an average LTCD4+ rate slightly higher than that of our study at inclusion of 252.02cells/mm^3 [32] . In Togo, Mouharita-Touré et al., (2011) showed median LTCD4 levels close to those of our study (121 cells/mm3) [33]. Administration of effective triple antiretroviral therapy is associated with a significant increase in the levels of memory TCD4+ and naive TCD4+ lymphocytes and a gradual and slow restoration of lymphocyte functions.[34].;

4.2.3. Variation in CD4 count and viral load in PLHIV

Figure 3 shows the relationship between the CD4 count and the viral load studied using correlation tests. These tests were applied after selecting patients who had both the results of the CD4 count and those of the viral load measurement under antiretroviral treatment. This study was part of the monitoring of PLHIV; the biological data were therefore respectively studied after months of antiretroviral treatment in accordance with the National Policies, Standards and Procedures for the Management of STIs. Two examinations were necessary for monitoring. These are the CD4 lymphocyte count and the viral load measurement. At the end of this study, it appears that when the CD4 lymphocyte count increases, the viral load decreases (undetectable) and when the CD4 lymphocyte count decreases, the viral load increases (becomes detectable).

4.3. Pathophysiological variations of hematological parameters in HIV-positive people under antiretroviral treatment

Table 2 shows that out of 203 patients living with HIV (53%) had a low hemoglobin level (average 9.86g/dl). Our results are similar to those reported by Coulibaly B in Mali**,** in 2017, which found 65.9% of cases of anemia with an average of 8.1 g/dl [35].

Table 2 shows that of the 107 patients living with HIV with a low hemoglobin level, the anemic typology is as follows: 31 patients had a hemoglobin level between 10 and 11 g/dl, or 29%, 46 patients had a hemoglobin level between 8 and

9 g/dl, or 43% and 30 patients had a hemoglobin level ≤ 7 g/dl, or 28%. The levels varied between 2.5 g/dl to 14.2 g/dl with an average of 9.86 g/dl. Data in litterature show that haematological abnormalities such as

anaemia, leucopenia, and thrombocytopenia are common complications of Human Immunodeficiency Virus (HIV) infection [**36**].

Then that in patients living with HIV, the hemoglobin level must be monitored. For patients suffering from mild anemia and moderate anemia, this situation could be corrected by a good rich and balanced diet. However, those with severe anemia should receive a blood transfusion before any drug treatment.

Table 2 shows that of the 107 patients living with HIV who were anemic, 21% (22/107) of patients had a MCV < 80 femtoliters (fl), characterizing microcytic anemia, and 79% (85/107) patients had a MCV between 100 < MCV > 80 fl, corresponding to normocytic anemia. The Mean Cell Volume varied between 18.5 to 98.93 femtoliters with an average of 58.71 fl. Indeed, iron deficiency explains microcytic anemia.

Table 2 shows that out of the 107 anemic patients living with HIV, 66% of patients (71/107) had a MCHC between: 32 and 36g/dl (32<MCHC<36 g/dl), a sign of normochromic anemia, 31% of patients (33/107) had a MCHC value < 32 (a sign of hypochromic anemia), finally 2.2% of patients (3/107) had a MCHC value =36 (a sign of hyperchromic anemia). The Mean Corpuscular Hemoglobin Concentration varied between 15.2 and 38.2 with a mean of 32.98 g/dL.

The table2 shows that of the 107 patients living with HIV and anemic, 71% (76/107) had a low hematocrit, 21.49% of patients (23/107) had normal hematocrit values (33.3-38.3%), and 7.47% (=8/107) of PLHIV had high values.

Analysis of this table shows that out of the 107 patients living with HIV, 70 patients had low leukocyte values, or 65.42%, 7 patients had normal values, or 6.54% and 30 patients had high values, or 28.03%. This increase in leukocyte content reflects the existence of an infection. On the other hand, low values indicate immune depression.

Analysis of this table shows that of the 107 patients living with HIV, 40% of them (43/107) had low neutrophil values, 6.54% (7/107) of patients had normal values, and 53.27% (=57/107) of patients had high values.

Analysis of this table shows that of the 107 patients living with HIV, 60.74% (65/107) of patients had low lymphocyte values, 6.56% (7/107) of them had normal lymphocyte values, and 32.71% (35/107) of patients had high values.

Analysis of table 2 shows that out of the 107 patients living with HIV, 54.20% (58/107) of patients had low monocyte values, while 38.31% (41/107) had normal monocyte values, and finally 7.74% (8/107) had high values.

Analysis of this table shows that out of the 107 patients living with HIV, 32 patients had low platelet values or 31.77% (34/107), 25 patients had normal values, or 23.36% and 48 patients had high values, or 44.85%.

In light of these data, we can notice that if the abnormal values (anemia) of the hematological parameters are different in general from those of Bhardwaj et al., (2020), these data could be comparable [**36**]. Indeed, these authors reported in their study that anemia was observed in 87 cases (72.5%). These authors reported that leukopenia was observed in 18.33% of patients against 65.42% in this present work (Table 2),and lymphopenia in 49.17% against 60.74 in this present work. Also, these authors [**36**] reported thrombocytopenia in 15.83% of cases against 31.77% in this present study, while neutropenia was observed only in 5% of cases against 40.18% of this present work (Table 2).

Hematological abnormalities during HIV occur in 92% of patients during the course of the disease. They are the result of the consequences of immunodeficiency and/or dysfunction of the immune system, complications of infections (bacterial, viral or fungal), side effects of multiple treatments and the direct role of the virus on certain hematopoietic progenitors and blood cells. These different results show the level of failure of the patients' immune system and the state of vulnerability of their body. This explains the failure of the treatment of Patients with ARVs.

The aim of this study was to evaluate and compare the measurement of plasma HIV-1 RNA viral load versus CD4 count in the biological monitoring of antiretroviral treatment. Thus, the determination of viral load in the biological and therapeutic monitoring of PLHIV/AIDS has improved patient care, by allowing on the one hand the early screening of immunological status in order to avoid antiviral therapeutic failures, and on the other hand the maintenance of first-line ARV thanks to the identification of slow responders. Monitoring ARV treatment as a priority by measuring HIV-1 viral load is therefore justified. It is necessary to study the dynamics of evolution of viral load and CD4 in a longitudinal study.

Previous studies have noted that most patients are detected late at a symptomatic stage and most often during severe inaugural opportunistic infections and classifying at the AIDS stage. The impact of this diagnosis and late management is measured at the individual level in terms of morbidity and mortality linked to opportunistic infections, but also in terms of public health due to the transmission of the infection within the community.

The individual and collective benefits of early care justify the new "Test and Treat" strategy, which is the basis for the ambitious targets of achieving "95-95-95" by 2020 and elimination by 2030. This "95-95-95" approach, initiated in 2015 by UNAIDS, aims to achieve by 2020 that 95% of all PLHIV know their HIV status, 90% of people who know their HIV status have access to treatment and 95% of people on treatment have an undetectable viral load. We must redouble our efforts to avoid the worst-case scenario of 7.7 million additional HIV-related deaths in the next 10 years, the increase in the number of HIV infections due to interruptions in HIV services during the COVID-19 pandemic and the slowdown in public health action.

This present work allowed the determination of the viral load and the hematological profile in the biological and therapeutic monitoring of HIV/AIDS patients in order to evaluate and improve the management of patients, by the early screening of their immunological and hematological status in order to avoid antiviral therapeutic failures and to ensure maintenance under first line of ARV thanks to the identification of slow responders.

5. Conclusion

This present work made it possible to determine the viral load and the hematological profile of PLHIV/AIDS, thus showing on the one hand that immunodepression was generally advanced, because lymphocyte levels were often low and the viral load was high, and on the other hand that the hematological parameters were at the same time disturbed (anemia, leukopenia), thus making it possible to evaluate and improve patient care and avoid antiviral therapeutic failures.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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