

Original Article

Evaluation of the biochemical, hematological and immunological profile in patients with a recent diagnosis of HIV in Santarém Reference Center, Pará, Brazil*Avaliação do perfil bioquímico, hematológico e imunológico em pacientes com diagnóstico recente para HIV de um Centro de Referência em Santarém, Pará, Brasil***Beatriz Toyama Watanabe¹, Olívia Campos Pinheiro Berretta², Erek Fonseca da Silva³, João Guilherme Pontes Lima Assy², Eduardo Vignoto Fernandes⁴, Luiz Fernando Gouvêa-e-Silva⁴**

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ABSTRACT: *Introduction:* Hematological, biochemical, and immunological alterations may already be present in HIV-infected patients at the time of diagnosis or before, or after starting antiretroviral therapy. *Objective:* Analyze the biochemical, hematological, and immunological profile of patients with a recent diagnosis of HIV. *Method:* The study evaluated 321 medical records of patients newly diagnosed with HIV infection. Data collection involved sociodemographic (date of birth, age, gender, education, marital status, employment relationship, and origin), clinical (date of diagnosis for HIV infection, immunodeficiency status, and type of exposure), biochemical (glucose, triglycerides, total cholesterol, and fractions), hematological (hemoglobin and platelet) and immunological (CD4+ T lymphocytes and viral load) information. Data were analyzed by descriptive and inferential statistics, adopting $p < 0.05$. *Results:* There was a predominance of males (67%), aged 18-27 years (39.9%), single (58.6%), and 32% of patients had AIDS. Of the variables analyzed, males presented higher amounts of hemoglobin and lower values for CD4+ T lymphocyte count, glucose, and total cholesterol in relation to females ($p < 0.05$). In addition, it is noteworthy that 69% of the sample presented a lipid alteration, 96% had a detectable viral load, and 71% had CD4+ T lymphocytes < 200 cells/mm³. *Conclusion:* People living with HIV, at the time of diagnosis, may present immunological, hematological, and biochemical alterations, making multidisciplinary evaluation, follow up, and guidance essential, both before and after the introduction of antiretroviral therapy, in order to avoid future health problems.

Keywords: Acquired immunodeficiency syndrome; Hematologic diseases; Dyslipidemias; CD4-positive T-Lymphocytes.

RESUMO: *Introdução:* Alterações hematológicas, bioquímicas e imunológicas podem estar presentes no paciente infectado pelo HIV, no momento do diagnóstico, antes ou depois de iniciar com os antirretrovirais. *Objetivo:* Analisar o perfil bioquímico, hematológico e imunológico de pacientes com diagnóstico recente para HIV. *Método:* O estudo avaliou 321 prontuários de pacientes recém diagnosticados com a infecção pelo HIV. A coleta de dados envolveu informações sociodemográficas (data de nascimento, idade, sexo, escolaridade, estado civil, vínculo empregatício e procedência), clínicas (data do diagnóstico para a infecção pelo HIV, situação de imunodeficiência e tipo de exposição), bioquímicas (glicose, triglicerídeos, colesterol total e frações), hematológicas (hemoglobina e plaqueta) e imunológicas (linfócitos T CD4+ e carga viral). Os dados foram analisados por estatística descritiva e inferencial, adotando-se $p < 0,05$. *Resultados:* Notou-se predominância do sexo masculino (67%), faixa etária de 18-27 anos (39,9%), solteiros (58,6%) e com 32% dos pacientes apresentando Aids. Das variáveis analisadas, o sexo masculino apresentou, em relação às mulheres, maior quantidade de hemoglobina e menores valores para contagem de linfócitos T CD4+, glicose e colesterol total ($p < 0,05$). Além disso, ressalta-se que 69% da amostra apresentou alguma alteração lipídica, 96% tinha carga viral detectável e 71% apresentou linfócitos T CD4+ < 200 cel/mm³. *Conclusão:* Pessoas vivendo com o HIV, no momento do diagnóstico, podem apresentar alterações imunológicas, hematológicas e bioquímicas, tornando imprescindível a avaliação, acompanhamento e orientação multiprofissional, tanto antes como posterior introdução dos antirretrovirais, a fim de evitar futuros agravos a saúde.

Palavras-chave: Síndrome de imunodeficiência adquirida; Doenças hematológicas; Dislipidemias; Linfócitos T CD4-positivos.

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INTRODUCTION

Over time, human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (AIDS) has ceased to be an acute and fatal disease, but with the advancement of science, has become a chronic disease. However, HIV/AIDS requires complex treatment and is accompanied by labeling and social judgments¹, which make it difficult for the patient to live with the disease, impairing the patient's adherence to their medical routine and antiretroviral therapy (ART)^{1,2}.

According to global data on HIV, 38 million people were living with the virus by the end of 2019³. According to the Epidemiological Bulletin, 13,677 new cases of people living with HIV were diagnosed in Brazil, defining a rate of 17.8 cases per 100,000 inhabitants in 2020. The northern region of the country is the largest pole of HIV dissemination, since it has a higher rate than the national level, of 26 cases per 100,000 inhabitants. In the northern region, the state of Pará presents the highest number of cases of HIV infections, 44%⁴, making studies of this disease relevant in the state.

The decrease in HIV deaths in recent years is due to the increased dissemination of and access to ART, as advocated by "Treatment for All", and to early diagnosis⁴. These factors, to an extent, meet the 90-90-90 goal, that is, 90% of HIV-infected people diagnosed, of these, 90% undergoing treatment, and 90% of this group have an undetectable viral load⁵.

However, it is observed that HIV infection, in addition to all its interferences in the immune system, when related to the use of ART, may also be associated with the development of adverse reactions². In this sense, anemia⁶, lipodystrophic syndrome⁷, glucose alterations⁸, metabolic syndrome, and increased cardiovascular risk stand out^{9,10}. These negative effects interfere significantly in the body of these patients, making it important to investigate these alterations to better guide the patient.

In view of the above, the present manuscript aimed to analyze the biochemical, hematological, and immunological profile of patients with a recent diagnosis of HIV.

METHODS

The study is descriptive, cross-sectional, and quantitative, carried out at the Center for Testing and Counseling and Specialized Assistance Service (CTC/SAS) in Santarém, Pará, Brazil.

The study population consisted of 344 medical records of patients who were diagnosed with HIV infection from January 2016 to December 2017. According to the inclusion criteria (medical records of HIV-infected patients in the years 2016 and 2017) and exclusion criteria (under 15 years of age, illegible or damaged medical records), 23

medical records/patients were withdrawn from the study, resulting in a sample including 321 medical records of patients (93% of the population), of both sexes.

The current study is part of a thematic project approved by the Research Ethics Committee of Campus XII – Santarém of the Universidade do Estado do Pará, under CAAE: 82729718.7.0000.5168.

The information collected was exclusively based on searching the medical records of patients treated at the CTC/SAS, at the time related to their diagnosis of HIV infection. Thus, sociodemographic (date of birth, age, sex, education, marital status, employment link, and origin), clinical (date of diagnosis for HIV infection, immunodeficiency situation, and type of exposure), biochemical (glucose, triglycerides, total cholesterol, and fractions), hematological (hemoglobin and platelet), and immunological (CD4+ T lymphocyte count - CD4+TL and viral load) information was collected. Based on the regional characteristics of the patients treated, an interval of up to four months was accepted between the date of diagnosis for HIV infection and the date of the laboratory examination performed.

The reference value adopted for blood glucose was according to Sposito et al.¹¹, and for triglycerides, total cholesterol, and their fractions was as proposed by Faludi et al.¹². In addition, the cut-offs of Segato et al. were adopted¹³ for CD4+TL (< or ≥200 cells/mm³) and for viral load (≥50 copies – detectable or <50 copies – undetectable). For anemia the reference presented by Ribeiro-Alves and Gordan¹⁴ was considered, and for platelet count normality the values of Barbosa et al.¹⁵.

For the evaluation of the immunodeficiency situation for AIDS, the count of CD4+TL <200 cells/mm³ or the presence of opportunistic infection or diagnosis of cancer was considered¹⁶.

Data were tabulated and analyzed for normality using the Gauss curve, with the Graphpad Prism 3.0 program. For the comparisons performed, between genders and between patients using (ART) and not using antiretroviral therapy (Naive), the independent T-test (for parametric data) and Mann-Whitney test (for non-parametric data) were adopted. In addition, associations were performed using the chi-square test. To verify the possibility of occurrence of the event, the Odds Ratio (odds ratio) test was used. The BioEstat 5.3 program was used to perform these tests and the significance level adopted was $p < 0.05$.

RESULTS

Table 1 presents the data are presented, in total, by sex, and by the use of ART, age group, marital status, education, type of exposure, and immunodeficiency situation. Analyzing the distribution by sex within the age groups from 18 to 37 years old and from 38 to 57 years old, it was noted that men are more frequent in the first

age group (73.1% vs 54.3%) and women in the second. (41.8% vs 24.5%) ($p=0.0016$; OR = 2.30). The presence of AIDS between the sexes was not associated ($p=0.8951$),

but an association was observed for the use or not of ART ($p=0.0016$), that is, AIDS patients are 2.8 times more likely to be on ART.

Table 1. Distribution of HIV-infected patients with respect to sociodemographic and clinical characteristics, according to sex and the use of antiretroviral drugs.

Variables	All (n/%)	Male (n/%)	Female (n/%)	Naive (n/%)	ART (n/%)
Age (years)					
18 I-I 27	128/39.9	94/43.5	34/32.4	33/41.3	95/39.4
28 I-I 37	87/27.1	64/29.6	23/21.9	21/26.3	66/27.4
38 I-I 47	67/20.9	38/17.6	29/27.6	12/15.0	55/22.8
48 I-I 57	30/9.3	15/6.9	15/14.2	11/13.8	20/8.3
58 I-I 67	7/2.2	4/1.9	3/2.9	1/1.3	5/2.1
68 I-I 77	2/0.6	1/0.5	1/1.0	2/2.5	0/0.0
Marital status					
Married/Stable Union	109/34.0	63/29.1	46/43.8	24/30.0	85/35.3
Single	188/58.6	143/66.2	45/42.8	50/62.5	138/57.3
Divorced	8/2.5	4/1.9	4/3.8	2/2.5	6/2.5
Widowed	9/2.7	0/0.0	9/8.6	2/2.5	7/2.9
Not found	7/2.2	6/2.8	1/1.0	2/2.5	5/2.1
Schooling					
Illiterate	5/1.6	4/1.9	1/1.0	1/1.3	4/1.7
Elementary (complete/incomplete)	124/38.6	70/32.4	54/51.4	36/45.0	88/36.5
Secondary (complete/incomplete)	133/41.4	89/41.2	44/41.9	31/38.8	102/42.3
Higher (complete/incomplete)	59/18.4	53/24.5	6/5.7	12/15.0	47/19.5
Employment Link					
With	213/66.0	171/79.0	42/40.0	54/67.5	159/66.0
Without	108/34.0	45/21.0	63/60.0	26/32.5	82/34.0
Type of Exposure					
Sexual intercourse	315/98.2	211/97.7	104/99.0	79/98.8	236/97.9
Blood transfusion	2/0.6	1/0.5	1/1.0	1/1.2	1/0.5
Vertical transmission	2/0.6	2/0.9	0/0.0	0/0.0	2/0.8
Not found	2/0.6	2/0.9	0/0.0	0/0.0	2/0.8
Immunodeficiency Status					
HIV	217/68.0	145/67.0	72/69.0	66/82.5	151/62.7
AIDS	104/32.0	71/33.0	33/31.0	14/17.5	90/37.3
Sex					
Male	216/67.0	----	----	57/71.3	159/66.0
Female	105/33.0	----	----	23/28.8	82/34.0

Naive – not using antiretroviral therapy; ART – using antiretroviral therapy.

Source: authors

Complementing the information presented in Table 1, it is highlighted that males predominated, representing 67% ($n=216$) of diagnoses in the studied period, in addition, the mean age was 33.1 ± 11.0 years, being higher in the

female sex (35.7 ± 11.9 vs 31.8 ± 10.4 ; $p=0.0061$). It is noteworthy that 80 (24.9%) patients were not using ART and 241 (75.1%) had been using it for up to four months. The mean age did not show any difference between ART-

naïve individuals and those using ART (p=0.6848).

Considering the place of origin, the patients came from 21 municipalities, 3 of which are not in the state of Pará (Manaus-AM, Maués-AM, and Porto Velho-RO). The five most frequent cities were Santarém-PA (62.9%; n=202), Óbidos-PA (7.5%; n=24), Oriximiná-PA (5%; n=16), Alenquer-PA, Juruti-PA (3.7%; n=12, each), and Jacareacanga-PA (3.1%; n=10). In addition to these, the sample included patients from 12 other municipalities in the state of Pará (Monte Alegre, Prainha, Itaituba, Mojuí dos

Campos, Novo Progresso, Rurópolis, Terra Santa, Aveiro, Blterra, Curuá, Trairão, and Uruará).

Table 2 presents the mean values of biochemical, immunological, and hematological laboratory tests, as well as their comparisons. In addition, the distribution of the classification of these variables and their association with gender and ART use is observed. It is noted that there was an association of sex only with hemoglobin (p=0.0004), that is, women were 2.9 times more likely to have altered values for hemoglobin compared to men.

Table 2. Mean values and classification of laboratory variables at the time of diagnosis of HIV infection.

Variables	All	Male	Female	P OR	Naive	ART	P OR
Lymphocytes T CD4+							
Mean±SD	371.0±256.8	367.8±260.3*	377.5±251.3		419.06±292.97	362.85±250.02	
Adeq (n%)	176/71	120/73	56/68	0.5647	26/72	150/71	0.9518
Alt (n%)	71/29	45/27	26/32	---	10/28	61/29	---
Viral load							
Mean±SD	150,824.2±577,939.4	179,586.6±685,862.9	92,614.6±234,939.8		98,852.36±235,637.71	160,193.12±620,050.51	
Und (n%)	11/4	7/4	4/5	0.9281	1/3	10/5	0.8719
Det (n%)	243/96	163/96	80/95	---	38/97	205/95	---
Hemoglobin							
Mean±SD	12.8±2.2	13.5±1.9*	11.5±2.0		13.08±1.93	12.79±2.19	
Adeq (n%)	128/60	96/69	32/43	0.0004	19/66	109/59	0.6616
Alt (n%)	85/40	43/31	42/57	2.9	10/34	75/41	---
Platelets							
Mean±SD	223,361.5±87,763.7	220,901.8±86,336.3	228,069.0±91,010.1		239,545.45±69,643.12 [#]	220,939.46±90,111.54	
Adeq (n%)	139/82	94/85	45/76	0.3500	20/91	119/81	0.4005
Alt (n%)	30/18	17/15	13/24	---	2/9	28/19	---
Glucose							
Mean±SD	89.1±35.0	88.7±15.9*	89.7±56.0		96.19±17.70 [#]	88.26±36.40	
Adeq (n%)	131/83	84/81	47/87	0.4413	11/69	120/85	0.7275
Alt (n%)	27/17	20/19	7/13	---	5/31	22/15	---
Total Cholesterol							
Mean±SD	148.1±33.2	143.8±33.3*	157.4±31.2		152.41±30.78	147.59±33.48	
Adeq (n%)	140/91	96/91	44/90	0.9782	15/94	125/91	0.9667
Alt (n%)	14/9	9/9	5/10	---	1/6	13/9	---
LDL-c							
Mean±SD	83.2±29.0	80.3±28.9	89.1±28.7		94.98±23.77	81.36±29.41	
Adeq (n%)	109/96	76/99	33/89	0.0667	15/100	94/95	0.8308
Alt (n%)	5/4	1/1	4/11	---	0/0	5/5	---
HDL-c							
Mean±SD	38.6±19.7	38.8±22.5	38.1±11.8		34.04±7.49	39.33±20.94	
Adeq (n%)	35/28	27/32	8/21	0.2812	3/18	32/30	0.4513
Alt (n%)	89/72	58/68	31/79	---	14/82	75/70	---

Table 2. Mean values and classification of laboratory variables at the time of diagnosis of HIV infection*continuation*

Variables	All	Male	Female	P OR	Naive	ART	P OR
No HDL-c							
Mean±SD	110.0±32.8	107.4±32.7	115.7±32.7		120.99±25.75	108.48±33.45	
Adeq (n/%)	116/96	80/96	36/95	0.9449	15/100	101/95	0.8681
Alt (n/%)	5/4	3/4	2/5	---	0/0	5/5	---
Triglyceride							
Mean±SD	143.5±67.5	145.6±70.8	139.0±60.2		136.44±50.32	144.53±69.73	
Adeq (n/%)	89/63	61/63	28/62	0.9122	12/67	77/62	0.9094
Alt (n/%)	53/37	36/37	17/38	---	6/33	47/38	---

Naive – not using antiretroviral therapy; ART – using antiretroviral therapy; SD – standard deviation; Und – undetectable; Det – detectable; Adequate – adequate; Alt – altered; p – Chi-square test; OR – Odds Ratio Test; *Statistical difference from females; #Statistical difference from patients on ART; p<0.05.

Source: authors

Lipid alteration was considered to be any alteration in one of the lipid variables evaluated in this study. Thus, Table 3 presents the distribution of patients regarding the

presence of and the number of lipid alterations, as well as the association with sex and use or not of ART, which were not significant.

Table 3. Distribution of lipid alterations at diagnosis of HIV infection.

Variables	All (n/%)	Male (n/%)	Female (n/%)	p OR	Naive (n/%)	ART (n/%)	p OR
Lipid alteration							
Yes	112/69	75/68	37/73	0.6496	15/79	97/68	0,4708
No	50/31	36/32	14/27	---	4/21	46/32	---
Number of alterations							
1	72/64	50/67	22/59	0.5898	9/60	63/65	0,9341
>1	40/36	25/33	15/41	---	6/40	34/35	---
Number of alterations							
1	72/64,3	50/66,7	22/59,5		9/60	63/65	
2	31/27,7	21/28	10/27		6/40	25/26	
3	6/5,4	2/2,7	4/10,8		0/0	6/6	
4	1/0,9	1/1,3	0/0		0/0	1/1	
5	2/1,8	1/1,3	1/2,7		0/0	2/2	

Naive – not using antiretroviral therapy; ART – using antiretroviral therapy; p – Chi-square test; OR – Odds Ratio Test; p<0.05.

Source: authors

DISCUSSION

After analyzing the medical records of 321 HIV-infected patients, the results of the current study showed that more than half of the patients were young adults between 18 and 37 years old, male, single, and with an employment link, which is in agreement with other studies¹⁷. In addition, the male sex predominated among the patients studied, with a sex ratio of 2.05 (M:F), that is, 20.5 men for every 10 infected women, which is in line with national data⁴. According to Dias et al.¹⁸, 97.4% of those infected came into

contact with the virus through unprotected sex and 82.4% declared themselves to be heterosexual, demystifying the fact that it is a disease exclusively for homosexuals. This is due to the feeling of male superiority that encourages them to have unprotected sex and develop an illusory certainty that they can enjoy an irrepressible sexuality with multiple partners, which makes men more vulnerable to contracting HIV¹⁹, especially younger men (18-37 years), as observed in the present study.

Considering the origins of patients treated by the CTC/SAS, as expected, the city of Santarém was the most

frequent, as it is the city where the outpatient clinic is located. However, it is noteworthy that a little more than a third of the patients come from other municipalities to be monitored by the health team, demonstrating the regional importance of the CTC/SAS in Santarém.

Low CD4+TL count and detectable viral load are factors that, when presented together, represent a population oversight and, consequently, a high rate of late diagnosis of the virus among these people¹⁷. In this sense, the consultations associated with the diagnosis of HIV infection in the CTC/SAS of Santarém are apparently being made late, since in 94% of the patients the viral load was detectable and almost a third of the patients had a low CD4+TL count (<200 cells/mm³). A study showed that patients who underwent early treatment were less likely to develop a serious clinical event (27%), an AIDS-relevant factor (36%), or tuberculosis (51%). This highlights the necessity for the development of measures to anticipate this diagnosis, preventing future complications⁴, and aiding attainment of 90-90-90 goal⁵.

The main reasons for the occurrence of late diagnosis are difficult access to health services, stable marital status, low education, low demand for rapid HIV tests after unprotected sexual intercourse, and age, whereby the older the person, the less worried they are about this type of disease if they have a steady partner²⁰. In this way, there is a lack of control and a greater immunological compromise of the body of HIV-infected patients, which can hamper the effectiveness of ART and make these individuals more susceptible to diseases, especially opportunistic infections²¹. In this sense, it is noteworthy that in the present study, AIDS is present in almost a third of the sample, as well as that these patients showed a positive association with the use of ART. This is possibly due to the low rate of early diagnosis, which leads to a reduction in the CD4+TL count or the presence of opportunistic diseases, increasing the morbidity and mortality rate of these patients^{17,20}. Therefore, the immediate inclusion of ART is extremely necessary to reverse the situation of immunological fragility, reduce the transmissibility of the virus, and rehabilitate the patient, making them stronger so that they can live with the virus, and have, at least, a minimum quality of life^{2,17}.

In addition, it is noteworthy that males had a lower value in the CD4+TL count than females, although without association, and above 200 cells/mm³. Thus, the data presented by Branãs et al.²² emphasize that patients with a recent onset of ART did not show statistical differences between the sexes, while patients already using ART showed a significant difference, with the CD4+TL count being higher in women. Even with a high CD4+TL count, patients are at a high risk of developing opportunistic infections, however, those with an CD4+TL count <200 cells/mm³ become more vulnerable to opportunistic infections²¹, as well as subsequent death²³.

When considering the hematological profile, the study by Katemba et al.²⁴ observed that a little more than three-fifths of the participants had anemia and thrombocytopenia. In the present study, hemoglobin alteration was found in two-fifths of the sample and platelet alteration in around one-fifth. Feneke et al.⁶, observed that patients with a low CD4+ T lymphocyte count and non-adherence to ART are more likely to develop anemia. In the present study, there was no statistical difference in the mean and in the association with altered hemoglobin values between patients who were already using or not using ART.

In addition, other factors that predispose to the development of anemia are the female sex, black skin color, high viral load, low body mass index (<18.5 kg/m²), as well as advanced clinical stage of the disease and the presence of opportunistic diseases⁶. As for the female patients in the present study, there was a lower mean value for hemoglobin concentration, as well as a 2.9-fold greater chance of developing anemia compared to males.

Another hematological alteration found was thrombocytopenia. According to the values presented, 18% of the patients in the present study demonstrated an altered amount of platelets in the body. This alteration, since it is not as common as anemia, does not appear with a high frequency in HIV-infected patients. This is confirmed in the study by Bhardwaj et al.²⁵ who observed 15% of thrombocytopenic patients. In the present study, mean platelet values showed no difference between sexes, however, values were lower in patients using ART. The association between sex or the use of ART with an altered classification of platelets was not significant.

Thus, it is clear that hematological manifestations are complications that may be present in HIV-infected patients, providing a great impact on their lives²⁵, as well as on quality of life, since nutritional deficiencies, anorexia, the need to use drugs to control gastrointestinal disorders, malabsorption problems, and interference in blood clotting become common²⁴.

Regarding the biochemical profile, it can be seen that the values of glucose, total cholesterol, LDL-c, non-HDL-c, and triglycerides presented adequate values in most patients. This is due to the fact that the patients in this study were at the beginning of treatment, being naïve, or newly introduced to ART. Research carried out using three measurement tools (SCORE – Systematic Coronary Risk Evaluation; FRS – Framingham Risk Score; DAD – Data Collection on Adverse Events of Anti-HIV Drugs) showed that patients using ART have a higher cardiovascular risk than antiretroviral-naïve patients, which simultaneously alters the laboratory characteristics¹⁰. In addition, antiretroviral drugs have been shown to be responsible for increased insulin resistance and reduced insulin secretion, by interfering with glucose receptors²⁶. In the present study, patients using ART had lower mean blood glucose values compared to naïve individuals, however both were

within the normal range and without association with altered values.

On the other hand, a high frequency of patients presented altered values of HDL-c, which increases the chance of the development of metabolic syndrome and diabetes mellitus^{8,27}.

Denué et al.²⁸ observed that, before starting ART, women had higher values than men for total cholesterol, LDL-c, triglycerides, and HDL-c. This was also observed in the study of Beraldo et al.⁸, with patients already using antiretroviral drugs, in which women, in relation to men, presented more alterations in HDL-c and LDL-c. Considering blood glucose and total cholesterol, there was no statistical difference. In the present study, no changes were observed for LDL-c, HDL-c, and triglycerides, however blood glucose and cholesterol were higher in women and in ART-naive patients.

These lipid and blood glucose alterations, regardless of sex or the use of antiretroviral drugs, if not controlled, can be potentiated by the development of lipodystrophy⁸ and obesity²⁶, which, over time, will favor the emergence of diabetes mellitus²⁶ and atherosclerosis plaques²⁷.

In addition, HIV-infected patients on long-term ART tend to present more lipid alterations when compared to patients at the beginning of treatment⁹, as well as a higher prevalence of hypertension, metabolic syndrome, and diabetes mellitus²⁷. In this sense, the use of protease inhibitors and non-nucleoside reverse transcriptase inhibitors increases the risk for cardiovascular diseases, which may be associated with metabolic and anthropometric abnormalities²⁹.

In view of the above, attention is drawn to the fact that patients with an altered lipid profile have a high mortality rate, especially when related to cardiovascular diseases, liver diseases, non-AIDS-related malignancies, and lung diseases^{30,31}. However, it is also observed that good adherence to ART and early diagnosis of patients in the early stages of the disease significantly reduces the

mortality rate over the years³¹. Therefore, it is extremely important to carefully monitor these patients, maintaining proactive and preventive medical care for all HIV-infected individuals using ART³⁰.

The current study presents as a limitation the use of medical records to obtain the data. The lack of thorough medical records, with incomplete sociodemographic, clinical, and laboratory fields or with mistakes, led to the absence of information from some participants in certain variables.

CONCLUSION

In view of the presented findings, it is concluded that patients newly diagnosed with HIV infection may present immunological, hematological, and biochemical alterations, which makes it extremely important to carry out continuous medical follow-up of these patients. The study also points out that women have lower hemoglobin values than men, which may indicate a greater chance of developing anemia. In addition, it was identified that men have a lower mean CD4+TL count than women, although above 200 cells/mm³, making them less vulnerable to opportunistic infections. Furthermore, it appears that women present higher glucose and total cholesterol values than men, which may in the future favor the development of cardiovascular diseases, diabetes, and dyslipidemias.

On the other hand, patients with AIDS had a faster onset of ART, and patients using ART presented lower glucose and platelet values. In addition, these individuals may present up to five lipid alterations in relation to those not on antiretroviral therapy.

Thus, it is essential that patients at the Santarém CTC/SAS regularly maintain their medical follow-up, for the continuous assessment of their clinical and laboratory situation, as well as for the use and adherence of the necessary medications.

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