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Research Article

Clinical and Etiological Profile of Anemia in Human Immunodeficiency Virus Patients Hospitalized in a Referral Center in Bogotá

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Abstract

Introduction: Anemia resulting from chronic inflammation and opportunistic infections associated with HIV resembles other chronic inflammatory conditions, increasing the risk of anemia by up to 50%. This study aims to characterize hospitalized patients in the Internal Medicine service with anemia and HIV infection during the year 2023.

Methods: A cross-sectional observational study was conducted on patients hospitalized within the comprehensive subnetwork of the Centro Oriente Health Service in Bogotá, Colombia. Sociodemographic, clinical, and laboratory variables were analyzed using measures of central tendency and percentages.

Results: A total of 268 hospitalized patients were identified during the study period, with a prevalence of 52.8% of HIV patients presenting with anemia. The mean age of the cohort was 41.9 years, with an average age of HIV diagnosis at 35.3 years. Among patients with CD4 counts <200 cells/ml, the prevalence of mild anemia was 75%, moderate anemia 58.6%, and severe anemia 5.6%. Tuberculosis was the most frequently associated opportunistic disease, observed in 32.3% of cases. Functional iron deficiency was identified as the primary cause of anemia in 56.8% of patients.

Conclusions: More than 50% of hospitalized HIV patients were found to have anemia, which was attributed not only to HIV-related inflammation and opportunistic infections but also to functional iron deficiency. Comprehensive assessment of the ferrokinetic profile is, therefore, essential. Patients with anemia exhibited higher plasma viral loads and lymphopenia compared to those without anemia

INTRODUCTION

Anemia is a significant public health issue both in Colombia and worldwide. It is a global target of the World Health Organization (WHO) to reduce anemia prevalence by 50% by 2025 [1]. It is estimated that over 30% of the global population suffers from anemia, with children and women of reproductive age being the most affected, reaching prevalence rates between 20% and 37%. The primary cause is iron deficiency (iron-deficiency anemia), a problem exacerbated in resource-limited regions due to various chronic and infectious diseases, such as HIV [1-4]. Anemia can negatively impact physical capacity and work performance, reduce individual well-being, and increase the risk of adverse maternal and neonatal outcomes. These consequences may predispose individuals to chronic conditions such as hypertension and diabetes later in life. In this context, it is crucial to investigate the prevalence and characteristics of anemia in people living with HIV (PLWH) in Colombia [3,5].

This study aims to determine the prevalence and characterize anemia in a representative sample of PLWH in Colombia. Our hospital manages a substantial population of patients with these pathological features, including a high-risk population (homeless individuals, sex workers, migrants, substance users, etc.). These groups are particularly vulnerable to infection, therapeutic failure, and limited access to antiretroviral treatment (ART) programs [6,7]. In Colombia, the relationship between HIV and anemia and their outcomes has not been precisely documented, at least not in Bogotá. Observational studies in other regions have attempted to explore this relationship using heterogeneous samples. For instance, in 2013, Dr. Cordero conducted a study in Cartagena, Bolívar, on approximately 300 patients with HIV. In this cohort, 50% had anemia due to nutritional deficiencies, while the other 50% had anemia related to chronic disease. A statistical relationship was observed between higher viral loads (mean of 55,091 copies/mL) and lower CD4 counts (mean of 73 cells/mL) with hemoglobin levels below 8 g/dL [8].

Another example is the work of Dr. Sánchez in Medellín between 2017 and 2018. This cross-sectional descriptive study on a small sample of 30 patients described hematological characteristics in HIV-positive patients. Anemia prevalence was 50%, with 29% classified as macrocytic and associated with CD4 counts below 66 cells/mL. These findings highlight the potential impact of anemia and low CD4 counts on clinical outcomes, including infections and mortality [9].

In Bucaramanga, Dr. Giraldo conducted a retrospective study on a small sample of 37 patients, utilizing diagnostic tools such as bone marrow biopsies. Only 40% of the population had initiated ART at diagnosis, and nearly 57% had CD4 counts below 50 cells/mm^3. While causal relationships between cytopenias and CD4 counts were not established, likely due to the small sample size, the study demonstrated that cytopenias might be a definitive marker of progression to AIDS. This scenario underscores the need for more extensive research and analysis [10].

These studies demonstrate the limited evidence available in Colombia to characterize this population. Despite the well-known impact of anemia on quality of life and mortality, there is a lack of robust data to infer how anemia influences the natural course of the disease in our population. Beyond HIV infection, other variables such as Bogotá's high altitude and associated comorbidities may contribute to the development or behavior of anemia. Given the emergence of concepts like absolute and functional iron deficiency, which are often linked to inflammatory processes, it is increasingly relevant to explore their role in HIV management. Addressing these deficiencies is not only about managing opportunistic infections or ART but also about correcting anemia associated with inflammation [2,6,7]. This highlights the need to delve deeper into the medium- and long-term effects of anemia correction, including impacts on mortality, adverse reactions to ART, and the relationship between hemoglobin levels, CD4 counts, and the risk of infectious processes such as tuberculosis. Tuberculosis, in particular, has become increasingly prevalent in our country due to rising cross-border migration [11]. Additionally, the response of this population to correcting deficiencies, such as iron, vitamin B12, or folic acid supplementation, and its impact on clinical outcomes remains undescribed. No randomized clinical trials currently provide guidance for recommendations.

Given the evident lack of information regarding HIV and anemia in Bogotá, we propose this study to enable the analysis of multiple outcomes over time, thereby contributing greater clinical evidence for these patients and evaluating therapies aimed at this population. Furthermore, this study aims to encourage various scientific societies in the country to continue researching this vulnerable group. Therefore, the aim of this study is to determine the prevalence and characterize anemia in HIV-infected patients hospitalized at a level IV healthcare institution in Bogotá, Colombia, during 2023.

METHODOLOGY

Study Type

This was a descriptive, observational, cross-sectional study conducted on hospitalized patients within the comprehensive healthcare network of Centro Oriente in Bogotá, Colombia, from January 1 to December 31, 2023.

Study Population

Patients eligible for the study were identified using the following International Classification of Diseases, 10th Revision (ICD-10) codes: Acquired Immunodeficiency Syndrome (AIDS) (D849) and Human Immunodeficiency Virus (HIV) disease. Patients without an ICD-10 code due to diagnostic coding errors but listed in the Centro Oriente HIV Program registry were also included.

Inclusion and Exclusion Criteria

Inclusion criteria were: Patients aged 18 years or older diagnosed with HIV, with available viral load and CD4 count measurements, Patients diagnosed with anemia according to WHO criteria, defined as hemoglobin levels two standard deviations below the normal range for age and sex (<13 g/dL in men and <12 g/dL in women), categorized by severity

as follows: Grade I (mild): <13 g/dL to 10 g/dL, Grade II (moderate): <9.9 g/dL to 8 g/dL, Grade III (severe): <7.9 g/dL to 6 g/dL, Grade IV (life-threatening): <5.9 g/dL.

Exclusion criteria included: Pregnant patients, Patients with a history of kidney transplantation, Patients with a recent cancer diagnosis or a history of cancer in the past five years undergoing or having undergone immunotherapy, chemotherapy, radiotherapy, or surgical intervention, Patients who had received blood transfusions in the previous two months, Patients with intravenous iron replacement therapy within the last six months.

Variables and Statistical Analysis

Measured variables included demographic and clinical characteristics such as sex, age, marital status, education level, sexual orientation, occupation, age at HIV diagnosis, and clinical diagnoses including heart failure, chronic obstructive pulmonary disease, hypertension, chronic kidney disease, diabetes mellitus, coronary artery disease, and upper gastrointestinal bleeding. Additional variables included weight, height, diagnosis of opportunistic infections, lipid profile, CD4 count, anemia profile, ferrokinetic profile, and antiretroviral therapy.

Data analysis was performed using STATA® 15. Descriptive statistics were applied to clinical and sociodemographic variables as well as ferrokinetic and anemia profiles.

Sample Size and Sampling Method

A non-probabilistic convenience sampling method was used, selecting patients who met the inclusion criteria without introducing randomness into the process. Data were obtained from the internal registry of Hospital Universitario Santa Clara for patients hospitalized in the Internal Medicine Department.

Ethical Considerations

The protocol was approved by the ethics committee of the referral center involved in the research, under the category of risk-free research. Ethical principles outlined in the Declaration of Helsinki were followed, and no personal patient information was collected.

RESULTS

A total of 268 patients were analyzed during the period from January 1 to December 31, 2023. After applying the inclusion and exclusion criteria, 91 patients were excluded, leaving 177 patients for final analysis. The prevalence of anemia among HIV patients was 52.8%. The patients' ages ranged from 21 to 71 years, with a mean age of 41.9 years. The mean age at HIV diagnosis was 35.3 years, with a range of 14.2 to 49.5 years. Female patients comprised 22.1% of the study population. The most common marital status was single (77.8%), followed by married (11.3%), cohabiting (5.1%), divorced (3.9%), and widowed (1.7%) (Table 1).

Among the study participants, 73% had comorbidities, including heart failure (2%), hypertension and chronic obstructive pulmonary disease (6.86%), chronic kidney disease (5.1%), diabetes mellitus (3.4%), coronary artery disease (2.8%), and upper gastrointestinal bleeding (2.29%). Severe immunosuppression (CD4 <200 mm^3/L) was observed in 57.1%, and profound immunosuppression (CD4 <100 mm^3/L) was observed in 44.7%. Educational

Table 1: Sociodemographic and Clinical Characteristics of Patients Diagnosed with HIV

Variables	Hb > 13 g/dL	Hb 10-13 g/dL	Hb 8-9,9g/dL	Hb 6-7,9 g/dL
Female sex (%)	13(33,3)	12(30,7)	12(30,7)	12(30,7)
Age (Sd)	41,7(13,2)	44,5(11,0)	39,3(12,5)	37,7(10,2)
Heart Failure (%)	3(75)	1(25)	-	-
Chronic obstructive pulmonary disease (COPD) (%)	8(66,6)	4(33,3)	-	-
Hypertension (%)	8(66,6)	4(33,3)	-	-
Chronic kidney disease (%)	1(11)	3(33,3)	2(22,2)	3(33,3)
Type 2 diabetes mellitus (%)	4(66,6)	2(33,3)	-	-
Coronary disease (%)	3(60)	1(20)	1(20)	-
Upper gastrointestinal bleeding (%)	1(25)	2(50)	28(16,5)	-
Marital status				
Single	69(83,1)	38(73)	23 (74,1)	7(70,0)
Married	7(8,4)	7(13,4)	5(16,13)	1(10,0)
Divorced		2(3,85)	3 (9,6)	2(20,0)
Cohabiting	4(4,8)	5(9,62)		
Widowed	3(3,6)			
Age at HIV diagnosis (Sd)	33,5(13,7)	38,2(15,2)	35,6(13,3)	33(14,5)
Education level				
Illiterate	3(3,6)	2(3,8)		1(10,0)
Primary	6(7,2)	11(21,1)	6(19,3)	2(20,0)
Secondary	39(46,9)	18(34,6)	14(45,1)	4(40,0)
Technical education	31(37,3)	15(28,8)	9(29,0)	2(20,0)
Technologist	1(1,2)	1(1,9)		1(10,0)
University	3(3,61)	3(5,7)	2(6,4)	
Sexual orientation				
Men who have sex with men	25(30,8)	13(26)	7(23,3)	1(10,0)
Bisexual	3(3,7)	5(10,0)	1(3,3)	2(20,0)
Heterosexual	53(65,4)	32(64,0)	22(73,3)	7(70,0)
Occupation				
Homemaker	1(1,2)	1(1,9)	1(3,2)	
Employee	11(13,2)	10(19,2)	5(16,1)	
Unemployed	17(20,4)	17(32,6)	10(32,2)	6(60)
Student	3(3,6)	1(1,9)		
Worker	1(1,2)	5(9,6)		
Self-employed	50(60,2)	18(34,6)	15(48,3)	4(40)

levels among patients were distributed as follows: illiteracy (3.4%), primary education (14.2%), secondary education (42.6%), technical education in progress (32.3%), technical degree holders (32.3%), and university graduates (5.68%). Sexual orientations included predominantly heterosexual (66.6%), followed by men who have sex with men (26.9%), and bisexual (5.43%). The most frequent occupations were self-employed (48.4%), contract workers (14.7%), homemakers (1.7%), and students (3.4%). Notably, 28.4% of patients were unemployed (Table 1).

Clinical Characteristics

The mean Barthel Index score among all patients was 98 points (±5.0 points). The mean weight was 59.8 kg (±53.5 kg), height 163.9 cm (±7.22 cm), and body mass index (BMI) 20.7 kg/m^2 (±3.2 kg/m^2). Diagnoses of opportunistic infections were as follows: cryptococcosis (4.7%), histoplasmosis (0.83%), cytomegalovirus (4.7%), toxoplasmosis (4.7%), candidiasis (9.4%), HIV-related encephalopathy (1.2%), herpes simplex virus (1.1%), Kaposi's sarcoma (0.56%), lymphoma (1.6%), tuberculosis (32.2%), Pneumocystis jirovecii pneumonia (1.1%), and Salmonella septicemia (1.1%) (Table 2).

Lipid Profile and Laboratory Findings

Lipid profile values in HIV patients included total cholesterol (144.1 mg/dL ± 45 mg/dL), HDL cholesterol (31.4 mg/dL ± 13.2 mg/dL), LDL cholesterol (79.3 mg/dL ± 50.3 mg/dL), and triglycerides (173.5 mg/dL ± 91.8 mg/dL). The mean hemoglobin level was 12.3 g/dL (±2.7 g/dL), hematocrit 36.9% (±7.6%), mean corpuscular volume (MCV) 87 fl (±7.0 fl), and mean corpuscular hemoglobin (MCH) 29.4 g/dL (±2.7 g/dL). Other notable findings included lactate dehydrogenase (319.8 IU ± 353.4 IU), C-reactive protein (5.7 mg/dL ± 7.1 mg/dL), albumin (2.7 g/dL ± 0.5 g/dL), folic acid levels (13.9 ng/mL ± 19.8 ng/mL), vitamin B12 levels (619.2 pg/mL ± 239.2 pg/mL), transferrin saturation (21.3% ± 14.1%), TIBC (211.6 mcg/dL ± 51 mcg/dL), total iron (46.1 mcg/dL ± 29.3 mcg/dL), ferritin (616.7 mcg/dL ± 404 mcg/dL), and transferrin (144.8 mcg/dL ± 52.1 mcg/dL) (Table 3).

CD4 Levels and Anemia Severity

Among patients with CD4 levels >500 mm^3, 26.6% had no anemia, 4.1% had mild anemia, 27.5% had moderate anemia, and none had severe anemia. Patients with CD4

Table 2: Clinical Characteristics and Opportunistic Pathogen Diagnoses in Patients Diagnosed with HIV

Variables	Hb >13g/dL	Hb 10-13g/dL	Hb 8-9,9 g/dL	Hb 6-7,9g/dL
Barthel Index (%)	97(7,6)	99(2,6)	97,1(4,8)	100
Weight (kg) (Sd)	67,7(77,6)	54,8(8,9)	48,9(6,0)	56,3(10,0)
Height (cm) (Sd)	164,4(6,8)	164,9(7,8)	161,6(7,4)	163,2(5,9)
BMI (kg/m^2) (Sd)	21,8(2,9)	20,1(3,3)	18,9(3,0)	20,2(3,3)
Diagnosis of opportunistic microorganisms (%)				
Cryptococcosis	5(6,0)	2(3,8)	4(12,9)	
Histoplasmosis			2(6,4)	
Cytomegalovirus	2(2,4)	4(7,6)	1(3,2)	2(20,0)
Toxoplasmosis	5(6,0)	5(9,6)	1(3,2)	
Candidiasis	2(2,49	5(9,6)	3(9,6)	1(10,0)
HIV-related encephalopathy	1(1,2)			
Herpes simplex virus	2(2,4)			
Kaposi's sarcoma	1(1,2)			
Lymphoma	2(2,4)	1(1,9)		
Tuberculosis	22(26,5)	22(42,3)	10(32,2)	3(30,0)
Pneumonia due to Pneumocystis jirovecii	1(1,2)			1(10,0)
Pneumonia due to septicemia	2)2,4)	2(3,8)		1(10,0)
Salmonella septicemia		1(1,9)	1(3,2)	

Table 3: Laboratory Characteristics of Patients Diagnosed with HIV

Variables	Hb > 13 g/dL	Hb 10-13g/dL	Hb 8-9,9 g/dL	Hb 6-7,9 g/dL
Total cholesterol (mg/dL) (Sd)	157,6(38,9)	133,36(49,3)	122,8(41,6)	186(41,0)
HDL cholesterol (mg/dL) (Sd)	41,9(10,9)	24,8(8,1)	19,7(8,2)	28,5(3,5)
LDL cholesterol (mg/dL) (Sd)	76,0(41,3)	96,4(68,9)	56,2(29,2)	105,1(32,6)
Triglycerides (mg/dL) (Sd)	151,4(61,7)	201,5(118,2)	169,5(98,1)	205,6(99)
Hemoglobin (g/dL) (Sd)	14,8(1,2)	11,4(0,8)	9(0,5)	7,3(0,4)
Hematocrit (HCT) (%) (Sd)	43,5(3,7)	34,5(2,9)	27,4(1,8)	22,8(2,0)
Mean corpuscular volume (MCV) (fL) (Sd)	89,6(5,8)	86,1(7,0)	86(8,9)	84,4(5,3)
Mean corpuscular hemoglobin (MCH) (g/dL) (Sd)	30,6(2,5)	28,6(2,3)	28,2(2,9)	27,3(2,4)
Lactate dehydrogenase (LDH) (Sd)	250,5(204,9)	273,9(88,3)	559,2(716)	280(197,6)
C-reactive protein (CRP) (Sd)	4,39(6,3)	7,3(7,7)	6,4(8,6)	4,6(2,4)
Albumin (g/dL) (Sd)	3,1(0,7)	2,7(0,4)	2,5(0,4)	2,3(0,4)
Folic acid levels (ng/mL) (Sd)	41(52,1)	13,1(10,6)	7,4(3,2)	10,5(0,7)
Vitamin B12 levels (pg/mL) (Sd)	744,6(109,3)	515,3(211,7)	720,1(282)	581,5(82,7)
Ferritin (ng/mL) (Sd)	298,1(315,1)	698,5(376)	746(391,2)	938,5(123)
Transferrin saturation (%) (Sd)	21,9(6,5)	16,1(9,4)	29(19)	14,0(6,0)
Total iron-binding capacity (TIBC) (mcg/dL) (Sd)	272,8(53,1)	207,3(42,2)	192(47,1)	201,7(6,5)
Transferrin (mg/dL) (Sd)	198,5(55,0)	142,1(31,1)	112,5(55,7)	136,7
Total iron (mcg/dL) (Sd)	60(10,0)	33,5(24,4)	58,1(36,2)	33,0(14,7)

levels between 200-499 mm^3 had no anemia in 33.3%, mild anemia in 20.8%, moderate anemia in 13.7%, and no cases of severe anemia. Patients with CD4 levels <200 mm^3 had no anemia in 40%, mild anemia in 75%, moderate anemia in 58.6%, and severe anemia in 5.6% (Table 4).

Antiretroviral Therapy and Viral Load

Among the 177 patients, only 6.82% achieved virological suppression (viral load <50 copies/mL) with antiretroviral therapy, while 68.1% had a viral load >200,000 copies/mL. Additionally, 36.2% were newly diagnosed with HIV during hospitalization and were not yet on antiretroviral therapy. The remaining 63% were on antiretroviral treatment (Table 4).

Table 4: Paraclinical Characteristics and Antiretroviral Therapy in Patients Diagnosed with HIV

Variables	Hb > 13 g/dL	Hb 10-13g/dL	Hb 8-9,9 g/dL	Hb 6-7,9 g/dL
CD4 Levels				
CD4 > 500 mcL	20(26,6)	2(4,1)	8(27,5)	
CD4 200–499 mcL	25(33,3)	10(20,8)	4(13,7)	
CD4 < 200 mcL	30(40,0)	36(75,0)	17(58,6)	9(100)
Viral Load (copies)	74751,3(1 94406)	359294(83 8685,8)	761716,7(1 926115)	539544,2(7 21292,4)
Undetectable viral load (%)	9(10,8)	1(1,9)	2(6,4)	
Antiretroviral Therapy (%)				
Abacavir + Lamivudine + Efavirenz		1(1,9)	1(3,2)	
Abacavir + Lamivudine + Nevirapine	2(2,5)			1(10,0)
Abacavir + Lamivudine + Raltegravir	3(3,8)	1(1,9)		
Emtricitabine + Tenofovir + Atazanavir + Ritonavir	28(35,9)	15(29,4)		
Emtricitabine + Tenofovir + Dolutegravir	6(7,69)	7(13,7)	12(38,7)	1(10,0)
Emtricitabine + Tenofovir + Efavirenz	2(2,5)	1(1,9)	2(6,4)	
Emtricitabine + Tenofovir + Lopinavir + Ritonavir	2(2,5)			
Dolutegravir + Abacavir + Lamivudine	1(1,2)		2(6,4)	1(10,0)
Lamivudine + Tenofovir + Dolutegravir		1(1,9)	1(3,2)	
Atazanavir + Ritonavir + Tenofovir + Emtricitabine	1(1,2)			
Lamivudine + Abacavir + Nevirapine	2(2,5)			
Dolutegravir + Lopinavir + Ritonavir	1(1,2)			
No antiretroviral therapy	24(60,7)	17(33,3)	13(41,8)	6(60.0)
Deferred therapy		2(3,9)		1(10,0)

Iron Deficiency and Anemia

Among HIV patients, 52.8% had anemia. Functional iron deficiency was present in 56.8% of cases, defined by transferrin saturation levels below 20% (TSI <20%). Of these, 73.6% of patients with mild anemia, 33.3% with moderate anemia, and 100% with severe anemia had TSI <20%. Only 5.6% of patients had ferritin levels below 300 mg/dL. Additionally, 34.2% of patients had CRP levels >5 mg/dL (Table 5).

DISCUSSION

Anemia in patients with HIV, particularly in advanced stages such as AIDS, is associated with a worsened prognosis, reduced quality of life, and a significant increase in mortality rates. Iron deficiency is a common clinical problem in this population, stemming from multifactorial causes, including nutritional status, clinical and pharmacological history, and treatment adherence. The prevalence of anemia in our study was 52.8%. Global reports on the prevalence of anemia in HIV patients indicate a higher prevalence in our study compared to Guiying Cao's findings, which reported 39.7% [12]. Studies have shown that the prevalence of anemia (hemoglobin less than 12 mg/dL) among women with HIV is 37% [13]; in comparison, our study found a lower rate of 22.1%.

The etiology of anemia in HIV is multifactorial, encompassing both HIV-related and unrelated factors. Direct viral effects on hematopoiesis and opportunistic infections play a significant role. According to Vishnu et al., opportunistic diseases such as cytomegalovirus and Mycobacterium tuberculosis are associated with low hemoglobin levels and iron deficiency, particularly with M. tuberculosis. These findings align with our study, which identified opportunistic diseases in patients, including Kaposi's sarcoma (0.56%), lymphoma (1.6%), cryptococcosis (4.7%) [14], and tuberculosis, the most prevalent diagnosis (32.2%) [11].

Iron is an essential micronutrient and a key element

Table 5: Anemia Characteristics and Transferrin Saturation

Variables	Hb > 13 g/dL	Hb 10-13g/dL	Hb 8-9,9 g/dL	Hb 6-7,9 g/dL
Transferrin saturation <20%	3(42,8)	14(73,6)	5(33,3)	3(100)
C-reactive protein (CRP) (mg/dL)	17(25,3)	21(44,6)	9(34,6)	4(44,4)

in various physiological processes, including oxygen transport, DNA synthesis, ATP production, and immune function, particularly involving lymphocytes and NK cells. In this study, ferritin was used as a marker of iron deficiency; however, it is also an acute-phase reactant, limiting its reliability in chronic inflammatory conditions such as HIV. López et al., reported that plasma ferritin levels in HIV patients exceed 200 mcg/L in men and 300 mcg/L in women, making it a less reliable indicator of iron deficiency. In our study, the mean ferritin level was 298 mcg/L, independent of hemoglobin levels and serum iron concentrations [15].

Anemic patients in this study exhibited variable CD4 counts. Patients with hemoglobin levels below 10 g/dL also had lower CD4 counts, specifically below 200 mc/L. Similarly, Marchionatti et al., reported a prevalence of thrombocytopenia and anemia ranging from 7.2% to 84%, highlighting the variability and observational nature of previous studies, which carry a certain degree of bias [6].

When analyzing deficiency anemia in this study, more than half of anemic patients had iron deficiency, defined by transferrin saturation levels below 20% (56.82%). This classification aligns with inflammation-associated anemia linked to functional iron deficiency. No cases of vitamin B12 or folic acid deficiencies were identified. Ruiz's study in Peru reported that 70% of anemia cases were deficiency-related, compared to 30% caused by chronic disease. In our study, chronic disease was less prevalent as the sole etiology of anemia.

LIMITATIONS

This study has some limitations. Its retrospective design prevented adequate control of confounding factors, and causal relationships (cause-effect or effect-cause) could not be established, limiting the identification of precise risk and prognostic factors in this population. Data were obtained from a dynamic system, which may have introduced information bias due to incomplete or unreliable clinical records. Additionally, as a referral center and public institution, the population studied often faces significant economic, adherence, and follow-up challenges. Despite these limitations, this is one of the first studies on anemia and functional iron deficiency in HIV patients in our institution, providing valuable insights into the local behavior of the disease. Furthermore, the lack of prior research on this topic highlights opportunities to address gaps in national literature and serves as a reference framework for future studies.

CONCLUSIONS

Hospitalized HIV patients exhibited anemia in over 50% of cases, which was not solely attributed to inflammation from HIV or opportunistic infections but also to functional iron deficiency (transferrin saturation <20%). This condition was present in more than half of patients with moderate and severe anemia, underscoring the importance of assessing the complete ferrokinetic profile rather than relying solely on ferritin as a marker for iron deficiency.

Although the study design did not allow us to determine the underlying causes of this iron deficiency, addressing it could improve patient outcomes by enhancing control of HIV infection, opportunistic diseases, and associated chronic comorbidities. Patients with anemia demonstrated higher plasma viral loads and lymphopenia, which could have a significant impact on morbidity and mortality in this population.

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REFERENCES

1. Harding BN, Whitney BM, Nance RM, Ruderman SA, Crane HM, Burkholder G, et al. Anemia risk factors among people living with HIV across the United States in the current treatment era: a clinical cohort study. BMC Infect Dis. 2020; 20: 238.
2. Shen Y, Wang Z, Lu H, Wang J, Chen J, Liu L, et al. Prevalence of Anemia among Adults with Newly Diagnosed HIV/AIDS in China. PLoS One. 2013; 8: 1-6.
3. Sistema de Información Nutricional sobre Vitaminas y Minerales. Concentraciones de hemoglobina para diagnosticar la anemia y evaluar su gravedad. Vmnis. 2011; 1: 7.
4. Badireddy M, Baradhi KM. Chronic Anemia. StatPearls. 2023.
5. Colín-Ramírez E, Castillo-Martínez L, Orea-Tejeda A, Asensio Lafuente E, Torres Villanueva F, Rebollar González V, et al. Body composition and echocardiographic abnormalities associated to anemia and volume overload in heart failure patients. Clin Nutr. 2006; 25: 746-757.
6. Marchionatti A, Parisi MM. Anemia and thrombocytopenia in people living with HIV/AIDS: a narrative literature review. Int Health. 2021; 13: 98-109.
7. O'Mahony D, Mabunda SA, Mntonintshi M, Iruedo J, Kaswa R, Blanco-Blanco E, et al. Causes of Moderate and Severe Anaemia in a High-HIV and TB-Prevalent Adult Population in the Eastern Cape Province, South Africa. Int J Environ Res Public Health. 2023; 20: 3584.
8. Cordero Díaz L. Prevalencia de anemia carencial en pacientes adultos con infección por VHI en dos instituciones de salud de Cartagena entre 2012 y 2013. Universidad de Cartagena. Disponible en. 2013.
9. Martínez Sánchez LM, López López L, Quintero Moreno DA, Álvarez Hernández LF, Ruiz Mejía C, Restrepo Lozada MA, et al. Compromiso hematológico en pacientes con infección por virus de la inmunodeficiencia humana en un hospital universitario de la ciudad de n.d. 2021.

10. Giraldo-Bahamon G, Ramírez-Ramos CF, Motta-Quimabaya OY, Rivera-Marín JD, Areiza-Páramo JD, Serrano-Valderrama SR, et al. Evaluación de la médula ósea en pacientes citopénicos infectados con el virus de la inmunodeficiencia humana tipo 1 en hospital colom n.d. 2019; 165-174.

11. O'Mahony D, Mabunda SA, Mntonintshi M, Iruedo J, Kaswa R, Blanco-Blanco E, et al. Causes of Moderate and Severe Anaemia in a High-HIV and TB-Prevalent Adult Population in the Eastern Cape Province, South Africa. Int J Environ Res Public Health. 2023; 20.

12. Cao G, Wang Y, Wu Y, Jing W, Liu J, Liu M. Prevalence of anemia among people living with HIV: A systematic review and meta-analysis. E Clinical Medicine. 2022; 44.

13. Levine AM, Berhane K, Masri-Lavine L, Sanchez ML, Young M, Augenbraun M, et al. Prevalence and Correlates of Anemia in a Large Cohort of HIV-Infected Women: Women's Interagency HIV Study. J Acquir Immune Defic Syndr. 2001; 26: 28-35.

14. Vishnu P, Aboulafia DM. Haematological manifestations of human immune deficiency virus infection. Br J Haematol. 2015; 171: 695-709.

15. López-Calderón C, Palacios R, Cobo A, Nuño E, Ruiz J, Márquez M, et al. Serum ferritin in HIV-positive patients is related to immune deficiency and inflammatory activity. Int J STD AIDS. 2014; 26: 393-397.