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Assessment of Haematological Profile and CD4 Count of Patients with HIV Infection

Afreen Alam, Rakesh Jagat, Ram Singh Maniram, Bhawna Bhimte*

Department of Medical Biochemistry, Gandhi Medical College, Bhopal, India

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ABSTRACT

Background and aim: Human Immunodeficiency Virus (HIV) infection is associated with morbidity and mortality worldwide. Anemia is the most common complication of HIV infection, which may be attributed to insufficient production of red blood cells. The present study was conducted to assess the hematological profile of HIV-positive patients irrespective of therapy and to establish a correlation with CD4 count.

Material and methods: The present observational study was conducted at a tertiary care center in central India for two years, from June 2019 to June 2021. Clinical findings were noted, followed by hematological and CD4 investigations by flow cytometry.

Results: Two hundred HIV-positive patients were enrolled; the mean age was 35.67±10.48 years. The majority of HIV patients, 80%, had anemia. Leukocytopenia and leukocytosis were documented in 10% and 7.5% of cases, and thrombocytopenia was noted in 22% of cases of HIV. About 49% of cases had a CD4 count of less than 200, and 40% of cases had a CD4 count in the range of 200 to 500. Statistically significant (P-value < 0.05) association of low CD4 count with loose motions, weight loss, pallor, anemia, neutrophilia, and low Mean corpuscular hemoglobin concentration (MCHC), were noted. Statistically significant (P-value < 0.05) positive CD4 counts with hemoglobin, lymphocytes, blood glucose, Mean corpuscular hemoglobin (MCH), and MCHC and a negative correlation with neutrophils were found.

Conclusions: The study showed an association between hematological abnormalities in patients with HIV. CD4 counts are useful for staging and assessing the prognosis of patients with HIV infection.

1. Introduction

Human Immunodeficiency Virus is a lymphotropic virus replicating inside T helper cells (CD4 cells), gradually destroying them. CD4 cells are helper cells that initiate and coordinate the immune response by other immune cells like CD8 cells that fight infection. Depleting CD4 lymphocytes is responsible for opportunistic infections amongst patients with HIV.[1] Patients initially present with influenza-like illness, followed by a latent, asymptomatic phase. The mechanism of immunodeficiency involves activating the immune system to apoptosis of CD4 cells when the immune system remains activated. The marked reduction of CD4+T cells is associated with activating CD8+ T cells responsible for killing HIV-infected cells.[1] This activation is responsible for killing HIV-infected cells and producing antibodies. With advancing disease, the CD4+T cells are insufficiently produced compared to their destruction rate, leading to a full-blown Acquired Immunodeficiency Syndrome.[2] HIV infection disrupts normal hematopoiesis leading to cytopenias that include anaemia, thrombocytopenia, and neutropenia. Anemia is the most common complication of HIV infection that may be attributed to insufficient production of red blood cells. HIV infection also suppresses bone marrow activity at all stages of infection by altering cytokine expression and affecting the bone marrow microenvironment.[3] The incidence of lymphopenia, neutropenia and thrombocytopenia in patients with AIDS has been documented as 75%, 20%, and 30%, respectively.[4] However, in asymptomatic HIV patients, neutropenia and thrombocytopenia are uncommon, and the incidence of lymphopenia is 15%.[5] Decreased bone marrow activity secondary to HIV infection affects the Granulocyte colony-stimulating factor, which is essential for producing WBCs in the bone marrow. The present study was conducted at a tertiary care center to assess the hematological profile of HIV-positive patients at different stages irrespective of their treatment status and to assess their correlation with CD4 count.

2. Material and methods

Study Design

This observational study was conducted at the Department of Medicine and ART centre in collaboration with the Department of Biochemistry at 2000 bedded Tertiary Care Centre of Central India of the Hamidia Hospital Bhopal from June 2019 to June 2021.

* *Corresponding author. Bhawna Bhimte*
E-mail address: *bhawna_bhimte@yahoo.co.in*
Department of Medical Biochemistry, Gandhi Medical College, Bhopal, India
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Sample size

Two hundred patients attending ART centre of Hospital (Calculated by sample size formula using total registered HIV patients attending ART centre).

Study procedure

The study was carried out after obtaining Ethical clearance by Institutional Ethical Committee, permission from NACO, and obtaining written consent from HIV patients. Pre-validated questionnaire proforma has been used for noting details of patients regarding data of socio-demographic variables such as age, sex, and socioeconomic status. Initial symptoms or presenting features at the diagnosis were noted. The questionnaire entered a history of the mode of transmission, duration of HIV infection, and any treatment history. Patients with previously known hematological disorders and of age group less than 18 years were excluded from the study. Blood samples via venipuncture (2ml each) were withdrawn using universal aseptic precautions in a vacutainer to assess hematological parameters and for CD4 count. Samples were tested using Flow cytometry.

Statistical analysis

Data was compiled using MsExcel and analyzed using IBM SPSS software version 20. The Association of CD4 count with clinical parameters was assessed using the chi-square test, whereas the association of CD4 count with hematological parameters was assessed using an independent t-test. The correlation of CD4 count with continuous variables was assessed using the Pearson Correlation coefficient. A P-value less than 0.05 was considered statistically significant.

3. Results

Two hundred HIV-positive patients fulfilling the exclusion and inclusion criteria were enrolled for the study. The mean age of patients was 35.67±10.48 years, and 64.5% of the patients with HIV were males. Most patients with HIV had pallor (29%), followed by 19% and 9.5% cases with weight loss and fatigue (Fig. 1).

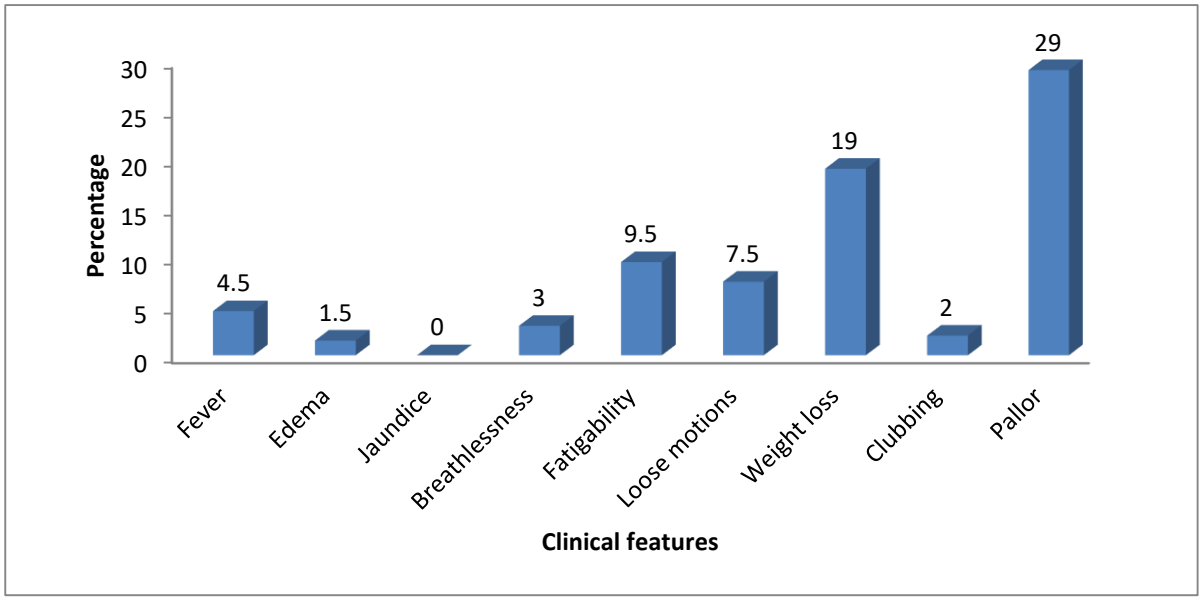

Fig. 1. Distribution according to clinical features.

Table 1 shows the hematological profile in patients with HIV. Mean hemoglobin in patients with HIV was 10.28±2.64 gm/dl, indicating that approximately 80% of the patients with HIV had anemia. Leukocytopenia and leukocytosis were documented in 10% and 7.5% of cases, respectively, whereas thrombocytopenia was noted in 22% of cases of HIV.

Table 1. Distribution according to complete hemogram of patients with HIV.

CBC		Frequency (n=200)	Percentage (%)
Hemoglobin (10.28±2.64 gm/dl)	No anemia	41	20.5
	Mild	27	13.5
	Moderate	89	44.5
	Severe	43	21.5
White blood cells (7045.20±6763.22 cells/mm^3)	< 4000	20	10.0
	4000 - 11000	165	82.5

	>11000	15	7.5
Neutrophils (64.58±10.66%)	< 40	3	1.5
	40 – 70	148	74
	>70	49	24.5
Lymphocytes (29.42±10.51%)	<20	29	14.5
	20 – 45	160	80
	>45	11	5.5
Monocytes (2.77±1.53%)	< 2	31	15.5
	2 – 8	168	84
	>8	1	0.5
Eosinophils (2.38±1.93%)	0 – 5	189	94.5
	>5	11	5.5
Basophils (%)	Normal	200	100
Platelets (2.11±0.89/lakh)	< 1.5	44	22
	1.5 – 4	150	75
	>4	6	3
	Mean		
MCV (fl)	< 80	66	33
	80 – 100	130	65
	>100	4	2
	Mean	83.36±11.07	
MCH (pg)	< 27.5	71	35.5
	27.5 – 33.2	125	62.5
	>33.2	4	2
	Mean	28.10±4.71	
MCHC (g/dl)	<33	69	34.5
	33 – 36	130	65
	>36	1	0.5
	Mean	33.57±3.34	

Our study's mean CD4 counts in HIV-positive patients was 252.31±186.16, and 89% of cases had CD4 counts less than 500. 49% of cases had a CD4 count of less than 200, and 40% of cases had a CD4 count in the range of 200 to 500 (Fig. 2).

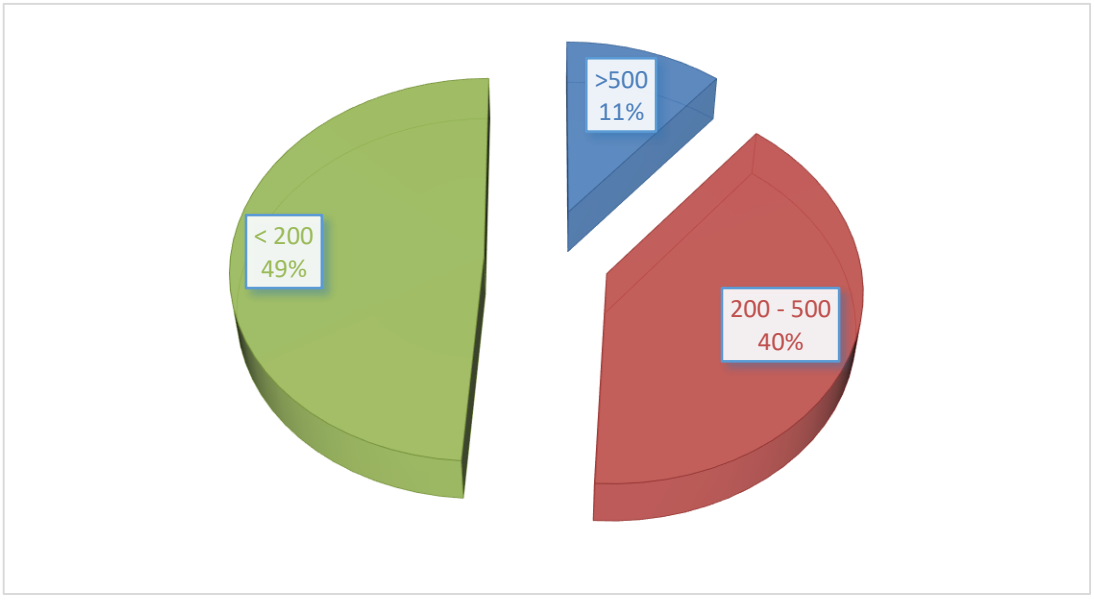

Fig. 2. Distribution according to CD4 counts.

When the association of CD4 level with symptoms of patients was established, it was a statistically significant association of loose motions, weight loss as well as pallor with low CD4 counts ($p<0.05$), whereas no such association, could be observed with other clinical features ($p>0.05$). (Table 2).

Table 2. Association of CD4 count with clinical features.

Clinical features	CD4			χ^2	P-value
	>500 (n=22)	200 – 500 (n=80)	<200 (n=98)		
Fever	0 (0)	4 (5)	5 (5.1)	1.7	0.56
Edema	0 (0)	1 (1.2)	2 (2)	0.6	0.76
Jaundice	0 (0)	0 (0)	0 (0)	NA	NA
Breathlessness	1 (4.5)	1 (1.2)	4 (4.1)	1.4	0.49
Fatigability	3 (13.6)	4 (5)	12 (12.2)	3.2	0.21
Loose motions	0 (0)	3 (3.8)	12 (12.2)	6.6	0.04
Weight loss	3 (13.6)	4 (5)	31 (31.6)	20.7	0.001
Clubbing	0 (0)	2 (2.5)	2 (2)	0.6	0.76
Pallor	5 (22.7)	14 (17.5)	39 (39.8)	11.1	0.004

The present study observed a statistically significant association of low CD4 count with moderate and severe anemia, neutrophilia, and low MCHC ($p<0.05$). (Table 3).

Table 3. Association of CD4 count with CBC.

CBC		CD4			P-value
		>500 (n=22)	200 – 500 (n=80)	<200 (n=98)	
Hemoglobin	No anemia	9 (40.9)	20 (25)	12 (12.2)	0.005
	Mild	2 (9.1)	15 (18.8)	10 (10.2)	
	Moderate	7 (31.8)	35 (43.8)	47(48)	
	Severe	4 (18.2)	10 (12.5)	29 (29.6)	
	Mean	10.91±2.36	10.90±2.53	9.64±2.65	
White blood cells	< 4000	1 (4.5)	7 (8.8)	12 (12.2)	0.62
	4000 - 11000	18 (81.8)	67 (83.8)	80 (81.6)	
	>11000	3 (13.6)	6 (7.5)	6 (6.1)	
	Mean	10390.91±18434.48	6795.63±2994.08	6497.86±3174.08	
Neutrophils	< 40	0 (0)	1 (1.2)	2 (2)	0.002
	40 – 70	16 (72.7)	71 (88.8)	61 (62.2)	
	>70	6 (27.3)	8 (10)	35 (35.7)	
	Mean	64.68±11.08	61.20±8.95	67.32±11.15	
Lymphocytes	<20	3 (13.6)	6 (7.5)	20 (20.4)	0.114
	20 – 45	19 (86.4)	69 (86.2)	72 (73.5)	
	>45	0 (0)	5 (6.2)	6 (6.1)	
	Mean	29.32±8.85	32.38±9.79	27.04±10.89	
Platelets	< 1.5	2 (9.1)	18 (22.5)	24 (24.5)	0.410
	1.5 – 4	20 (90.9)	60 (75)	70 (71.4)	
	>4	0 (0)	2 (2.5)	4 (4.1)	
	Mean	2.18±0.66	2.13±0.87	2.08±0.96	
MCV	< 80	6 (27.3)	20 (25)	40 (40.8)	0.129
	80 – 100	16 (72.7)	59 (73.8)	55 (56.1)	
	>100	0 (0)	1 (1.2)	3 (3.1)	
	Mean	82.03±15.11	84.94±9.58	82.37±11.11	
MCH	< 27.5	6 (27.3)	22 (27.5)	43 (43.9)	0.139
	27.5 – 33.2	15 (68.2)	57 (71.2)	53 (54.1)	
	>33.2	1 (4.5)	1 (1.2)	2 (2)	
	Mean	30.43±11.05	28.31±2.99	27.41±3.16	
MCHC	<33	4 (18.2)	20 (25)	45 (45.9)	0.001

	33 – 36	17 (77.3)	60 (75)	53 (54.1)	
	>36	1 (4.5)	0 (0)	0 (0)	
	Mean	35.75±8.99	33.65±1.35	33.019±1.60	

Study also documented a statistically significantly positive correlation of CD4 counts with hemoglobin (r=0.202; p=0.004), lymphocytes (r=0.187; p=0.008), blood glucose (r=0.243; p=0.001), MCH (r=0.203; p=0.004) and MCHC (r=0.209; p=0.003) and a negative correlation with neutrophils (r=-0.187; p=0.008) and serum urea (-0.260; p=0.001). (Table 4).

Table 4. Correlation of CD4 with various parameters.

	Pearson Correlation	P-value
Hemoglobin	0.202**	0.004
WBC	0.099	0.161
Neutrophils	-0.187**	0.008
Lymphocytes	0.187**	0.008
Monocytes	-0.021	0.763
Eosinophils	-0.045	0.529
Basophils	-----	-----
Platelets	0.016	0.82
MCV (fl)	0.089	0.208
MCH (pg)	0.203**	0.004
MCHC (g/dl)	0.209**	0.003

4. Discussion

In the present study, mean CD4 levels in patients with HIV infection were found to be 252.31±186.16, and CD4 counts were less than 200 in 49% of the cases, whereas counts ranged between 200 and 500 in 40% of cases. Parinitha et al., in their study, documented a CD4 count of less than 200 in 70% of the HIV-infected patients.[7] Sharika et al. also observed CD4 counts of less than 200 in 46.8% of patients, followed by 39.2% with CD4 counts in the range of 200-500.[8] The present study also aimed to assess the clinical features in patients with HIV and to assess its association with CD4 counts. According to WHO, persistent generalized lymphadenopathy, unexplained weight loss, and unexplained fever for a prolonged period are documented as clinical features of HIV infection. However, the clinical features of HIV vary depending upon the clinical stage of HIV infection. The present study showed pallor was the most common clinical feature observed in 29% of cases, followed by weight loss and fatigue in 19% and 9.5%, respectively. Amongst various clinical features, CD4 counts were significantly associated with loose motions, weight loss, and pallor ($p<0.05$). Srinivasa et al. observed fever, weight loss, lethargy, anorexia, diarrhea, cough, and oral ulcers in HIV patients, and CD4 counts were documented to be lower than 350 cells/μL in maximum cases who were symptomatic, supporting our study findings.[9] As discussed, the hematopoietic system is commonly involved in HIV patients but is often overlooked. Most hematopoietic lineages are affected in HIV patients and may manifest as pancytopenia due to decreased bone marrow activity. However, anemia is the most common complication in patients with HIV and results from insufficient production of red blood cells, ineffective erythropoiesis, infections, micronutrient deficiencies, and associated neoplasia.[4] Our study documented anemia of varying severity in 79.5% of the case with HIV, While 44.5% had moderate anemia. However, leukocytopenia and thrombocytopenia were noted in 10% and 22% of cases, respectively. In our study, neutropenia was observed in 1.5% of cases, whereas lymphocytopenia was documented in 14.5% of cases. Mathews et al. documented anemia in 40.1% cases, thrombocytopenia in 3.74%, and leucopenia in 5.88% in ART-Y and 8.14% in the ART-N group.[5] Thulasi et al. reported anemia, leucopenia, and thrombocytopenia in 77%, 21%, and 5%, respectively.[12] The present study showed a significant association of CD4 count with anemia, neutrophilia, and low MCHC ($p<0.05$). Significant positive correlation between CD4 count with hemoglobin, lymphocytes, MCH, and MCHC ($p<0.05$), whereas a negative correlation was noted with neutrophils ($p<0.05$)was noted. Kibaru et al. documented the effectiveness of HAART, which may reflect the CD4 count and disease status.[12] Thulasi et al. documented that CD4 count is inversely proportional to their study's severity of hematological abnormalities.[13] Duguma et al. also observed

CD4+ T-cell levels of <200 cells/μL as an independent risk factor for anemia and leukopenia in patients with HIV.[14]

5. Conclusion

One of the common findings is that patients with HIV infection may present with varied clinical features, hematological abnormalities, and particularly normocytic normochromic anemia. Apart from this, leukocytopenia and thrombocytopenia are also observed in a few cases. CD4 counts are used for staging and assessing the prognosis of patients with HV infection. CD4 counts are significantly associated with male gender, loose motions, weight loss, pallor, anemia, neutrophilia, MCHC, and USG abnormalities.

Conflict of Interest

The authors declared that there is no conflict of interest.

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References

[1] HIV/AIDS, Reproductive Health Matters. 2005;13(25):187–93 https://doi.org/10.1016/S0968-8080(05)25177-7.

[2] Jackson BS, Pretorius E. Pathological clotting and deep vein thrombosis in patients with HIV. InSeminars in thrombosis and hemostasis 2019;45(2):132-40. https://doi.org/ 10.1055/s-0038-1676374.

[3] Zon LI, Groopman JE. Hematologic manifestations of the human immune deficiency virus (HIV). InSeminars in hematology 1988;25(3):208-18.

[4] Nonnemacher MR, Quiterio S, Allen AG, Mele AR, Pirrone V, Wigdahl B. Myelomonocytic cell lines in modeling HIV-1 infection of the bone marrow. Biology of Myelomonocytic Cells. InTech. 2017;10:129-62. http://dx.doi.org/10.5772/67596.

[5] Mathews SE, Srivastava D, Yadav RB, Sharma A. Association of hematological profile of human immunodeficiency virus-positive patients with clinicoimmunologic stages of the disease. Journal of laboratory physicians. 2013;5(01):34-7. https://doi.org/10.4103/0974-2727.115929.

[6] Vaillant AA, Gulick PG. HIV Disease Current Practice. 2020.

[7] Parinitha SS, Kulkarni MH. Haematological changes in HIV infection with correlation to CD4 cell count. The Australasian medical journal. 2012;5(3):157-62. https:doi.org/ 10.4066/AMJ.20121008.

[8] Sharika S, Jayapal T, Stephenson J, DS AR, Rajasekharan C. The clinical profile of patients diagnosed as having HIV infection with special reference to Joint manifestations and its correlation with CD4 count. International Journal of Health and Clinical Research. 2021;4(8):249-53.

[9] Srinivasa Rao B, Jagannadham R, Manojna B. Relation between clinical profile, CD4 count and total lymphocyte count in HIV infected persons. Journal of Evidence Based Medicine and Healthcare. 2019; 6(52), 3225-9. https:doi.org/10.18410/jebmh/2019/677.

[10] Gange SJ, Lau B, Phair J, Riddler SA, Detels R, Margolick JB. Rapid declines in total lymphocyte count and hemoglobin in HIV infection begin at CD4 lymphocyte counts that justify antiretroviral therapy. Aids. 2003;17(1):119-21.

[11] Abebe M, Alemseged F. Hematologic abormalities among children on Haart, in Jimma university specialized hospital, southwestern ethiopia. Ethiopian Journal of Health Sciences. 2009;19(2):83-9. https:doi.org/10.4314/ejhs.v19i2.69420.

[12] Kibaru EG, Nduati R, Wamalwa D, Kariuki N. Impact of highly active antiretroviral therapy on hematological indices among HIV-1 infected children at Kenyatta National Hospital-Kenya: retrospective study. AIDS research and therapy. 2015;12(1):1-8. https://doi.org/10.1186/s12981-015-0069-4.

[13] Thulasi RR, Manimaran D, Hemanathan G, Afroz T, Sagar R. Hematological abnormalities in HIV infected individuals in correlation to CD4 counts and ART status. Asian Journal of Medical Sciences. 2016;7(4):14-8. https://doi.org/10.3126/ajms.v7i4.14033.

[14] Duguma N, Tesfaye Kiya G, Adissu Maleko W, Bimerew LG. Hematological parameters abnormalities and associated factors in HIV-positive adults before and after highly active antiretroviral treatment in Goba Referral Hospital, southeast Ethiopia: a cross-sectional study. SAGE open medicine. 2021. https://doi.org/10.1177/20503121211020175.

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