RESEARCH PAPER

Study Of Hematological Manifestations In Human Immunodeficiency Virus Infected Subjects In K. R. Hospital, Mysuru

Dr. Monika K R[1]*, Dr. Ashokavardhana S[2], Dr. Yashwanth N S[3], Dr. Vandana Balgi[4]

[1] *Senior Resident, Department of General Medicine, Kodagu Institute of Medical Sciences, Madikeri, Karnataka, India. Email: monikakr2012@gmail.com*

[2] *Assistant Professor, Department of General Medicine, Bangalore Medical College and Research Institute, Bengaluru, Karnataka, India. Email: ashokavs1995@gmail.com*

[3] *Sri Siddhartha Medical College, Tumkur, Karnataka, India. Email: yashwanth2302@gmail.com*

[4] *Assistant Professor, Department of General Medicine, Mysore Medical College and Research Institute, Mysuru, Karnataka, India.*

Corresponding Author:
Dr. Monika K R
Senior Resident, Department of General Medicine, Kodagu Institute of Medical Sciences, Madikeri, Karnataka, India. Email: monikakr2012@gmail.com

Received: 12-6-2025; Revised: 26-6-2025; Accepted: 5-7-2025; Available Online: 17-7-2025

ABSTRACT

Background: Human immunodeficiency virus (HIV) infection is associated with a wide spectrum of hematological abnormalities that contribute significantly to morbidity and disease progression. These abnormalities result from direct viral effects on the bone marrow, immune-mediated destruction of blood cells, opportunistic infections, nutritional deficiencies, and chronic inflammation. Early identification of hematological manifestations is essential for timely intervention and improved clinical outcomes in newly diagnosed HIV-infected individuals.

Aim and Objective: To study the hematological manifestations in newly detected human immunodeficiency virus-infected subjects.

Materials and Methods: This hospital-based cross-sectional observational study included 40 newly detected HIV-infected subjects attending K. R. Hospital, Mysuru. Demographic and clinical details were recorded, and hematological evaluation was performed using complete blood count, red cell indices, platelet count, differential leukocyte count, and peripheral blood smear examination. WHO clinical stage and CD4 count were documented. Data were analyzed using appropriate descriptive and inferential statistical methods, with a p-value <0.05 considered statistically significant.

Results: The majority of subjects were aged 41–50 years (45.0%), and 57.5% were males. Most patients belonged to WHO clinical stage II (60.0%), while 65.0% had CD4 counts below 200 cells/mm³. Anemia was the most common hematological manifestation, affecting 92.5% of subjects, with moderate anemia observed in 57.5%. Normocytic anemia was the predominant morphological pattern (45.0%). Lymphopenia was present in 75.0% of subjects, thrombocytopenia in 57.5%, severe neutropenia in 52.5%, and leucopenia in 35.0%. Severe neutropenia showed a significant association with WHO clinical stage ($p=0.005$). Leucopenia ($p=0.007$), thrombocytopenia ($p<0.001$), and severe neutropenia ($p<0.001$) were significantly associated with CD4 counts below 200 cells/mm³.

Conclusion: Hematological abnormalities are highly prevalent among newly detected HIV-infected subjects, with anemia being the most common manifestation. Significant associations between selected cytopenias and lower CD4 counts indicate that hematological abnormalities reflect the degree of immunosuppression. Routine hematological evaluation at the time of HIV diagnosis is essential for early detection, appropriate management, and improved patient outcomes..

Keywords: Human immunodeficiency virus, HIV, Hematological manifestations, Anemia, Leucopenia, Lymphopenia, Neutropenia, Thrombocytopenia, CD4 count, WHO clinical stage.

How to cite this article*:* Monika KR, Ashokavardhana S, Yashwanth NS, Balgi V.., Study Of Hematological Manifestations In Human Immunodeficiency Virus Infected Subjects In K. R. Hospital, Mysuru. Int J Drug Deliv Technol. 2026;16(75s): 571-576. DOI: 10.25258/ijddt.16.75s.67

Source of support: Nil.

Conflict of interest: Nil.

INTRODUCTION

Human immunodeficiency virus (HIV) infection remains a major global public health challenge despite remarkable advances in antiretroviral therapy (ART). The virus primarily targets CD4+ T lymphocytes, leading to progressive immune dysfunction and increased susceptibility to opportunistic infections, malignancies, and multisystem complications(1). In addition to its profound effects on the immune system, HIV has significant hematological consequences that contribute substantially to disease-related morbidity and mortality. Hematological abnormalities are among the earliest and most common

**Author for Correspondence: monikakr2012@gmail.com*

manifestations of HIV infection and may occur at any stage of the disease, even before the development of acquired immunodeficiency syndrome (AIDS) (2,3).

The hematopoietic system is affected through multiple mechanisms, including direct suppression of bone marrow progenitor cells by HIV, immune-mediated destruction of blood cells, opportunistic infections involving the bone marrow, nutritional deficiencies, and chronic inflammation (4). These factors can result in abnormalities involving one or more blood cell lineages. The severity and frequency of hematological manifestations often correlate with the degree of immunosuppression and disease progression, making them important clinical indicators of HIV severity (5).

Anemia is the most frequently encountered hematological abnormality in HIV-infected individuals and has been associated with reduced quality of life, impaired functional status, accelerated disease progression, and increased mortality. The etiology of anemia in HIV is multifactorial and includes anemia of chronic disease, nutritional deficiencies, bone marrow suppression, opportunistic infections, and less commonly, hemolysis (6). Leukopenia, particularly lymphopenia and neutropenia, is another important manifestation that predisposes patients to recurrent bacterial and fungal infections. Thrombocytopenia may occur due to immune-mediated platelet destruction, impaired platelet production, or advanced marrow involvement and can present with bleeding manifestations ranging from mild mucocutaneous bleeding to severe hemorrhage (7).

Routine hematological investigations such as complete blood count and peripheral blood smear examination provide valuable information regarding the extent of hematological involvement in HIV infection. These investigations are inexpensive, widely available, and useful for identifying abnormalities that may require further evaluation or specific management (8,9). Early recognition and appropriate treatment of hematological disorders can improve patient outcomes, reduce complications, and facilitate timely initiation of supportive care along with antiretroviral therapy (10) .

Although the burden of HIV infection has declined in many regions following widespread implementation of ART, newly diagnosed patients continue to present with hematological abnormalities, particularly in resource-limited settings where delayed diagnosis remains common (11). The pattern and prevalence of these manifestations may vary depending on demographic characteristics, nutritional status, stage of infection, prevalence of coexisting infections, and accessibility to healthcare services. Therefore, institution-specific data are essential for understanding the local spectrum of hematological abnormalities and guiding clinical management (12).

The present study was undertaken to evaluate the hematological manifestations in newly detected HIV-infected subjects attending K. R. Hospital, Mysuru. By assessing the spectrum of hematological abnormalities at the time of diagnosis, the study aims to generate clinically relevant data that may facilitate early identification of hematological complications, support appropriate therapeutic interventions, and improve comprehensive care for individuals living with HIV.

AIMS AND OBJECTIVES

To study the hematological manifestations in newly detected human immunodeficiency virus infected subjects.

MATERIALS AND METHODS

This hospital-based cross-sectional observational study was conducted among newly detected human immunodeficiency virus (HIV)-infected subjects attending K. R. Hospital, Mysuru. Consecutive eligible patients diagnosed with HIV during the study period were enrolled after obtaining written informed consent. Subjects fulfilling the predefined inclusion criteria were included, while those meeting the exclusion criteria or unwilling to participate were excluded. Relevant demographic and clinical details were recorded using a predesigned case record proforma.

All enrolled participants underwent a detailed clinical evaluation followed by hematological investigations. Venous blood samples were collected under aseptic precautions, and hematological parameters including hemoglobin concentration, total leukocyte count, differential leukocyte count, platelet count, red blood cell indices, and peripheral blood smear examination were assessed using standard laboratory methods. The hematological manifestations identified were documented and analyzed to determine their frequency and pattern among newly detected HIV-infected subjects.

The collected data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Descriptive statistical methods were used to summarize the hematological findings. Statistical significance was considered at a p-value of <0.05, wherever applicable. The study was conducted after obtaining approval from the Institutional Ethics Committee, and confidentiality of all participant information was strictly maintained throughout the study.

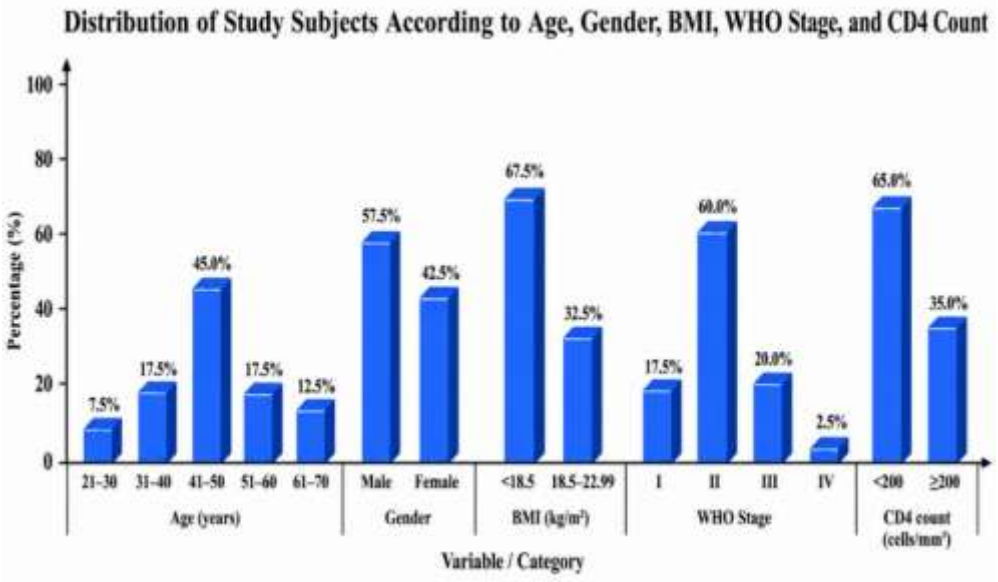
RESULTS

Table 1. Distribution of Study Subjects According to Age, Gender, BMI, WHO Stage, and CD4 Count

Variable	Category	n	(%)
Age (years)	21–30	3	7.5
	31–40	7	17.5
	41–50	18	45.0
	51–60	7	17.5

	61–70	5	12.5
Gender	Male	23	57.5
	Female	17	42.5
BMI (kg/m²)	<18.5	27	67.5
	18.5–22.99	13	32.5
WHO Stage	I	7	17.5
	II	24	60.0
	III	8	20.0
	IV	1	2.5
CD4 count (cells/mm³)	<200	26	65.0
	≥200	14	35.0

Graph 1. Distribution of Study Subjects According to Age, Gender, BMI, WHO Stage, and CD4 Count



In the present study, the highest proportion of study subjects belonged to the 41–50 years age group (18; 45.0%), followed by the 31–40 years and 51–60 years age groups, each comprising 7 (17.5%) subjects. The 61–70 years age group included 5 (12.5%) subjects, while the 21–30 years age group had the lowest representation with 3 (7.5%) subjects.

With respect to gender, 23 (57.5%) study subjects were male, whereas 17 (42.5%) were female.

Regarding BMI, the majority of study subjects (27; 67.5%) had a BMI <18.5 kg/m², while 13 (32.5%) had a BMI of 18.5–22.99 kg/m².

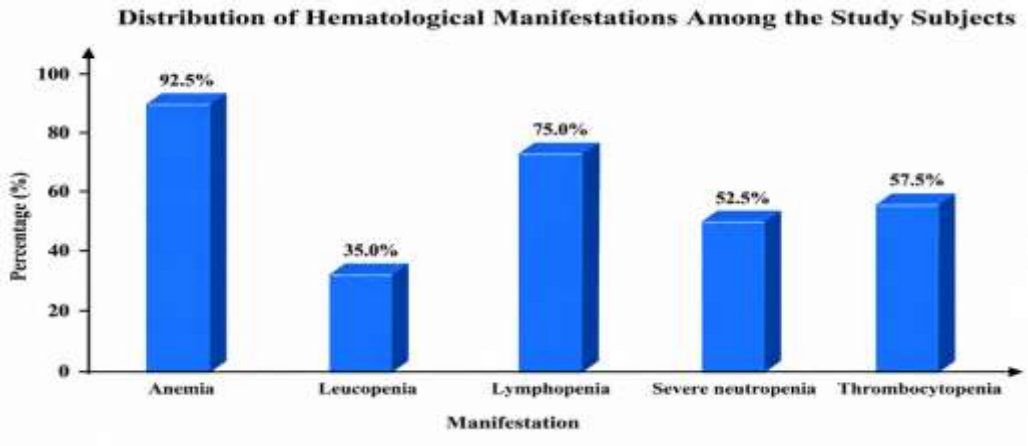
According to WHO clinical staging, the largest proportion of study subjects belonged to WHO Stage II (24; 60.0%), followed by WHO Stage III (8; 20.0%), WHO Stage I (7; 17.5%), and WHO Stage IV (1; 2.5%).

With regard to CD4 count, 26 (65.0%) study subjects had a CD4 count <200 cells/mm³, whereas 14 (35.0%) had a CD4 count ≥200 cells/mm³.

Table 2. Distribution of Hematological Manifestations Among the Study Subjects

Manifestation	**n**	**%**
Anemia	37	92.5
Leucopenia	14	35.0
Lymphopenia	30	75.0
Severe neutropenia	21	52.5
Thrombocytopenia	23	57.5

Graph 2. Distribution of Hematological Manifestations Among the Study Subjects

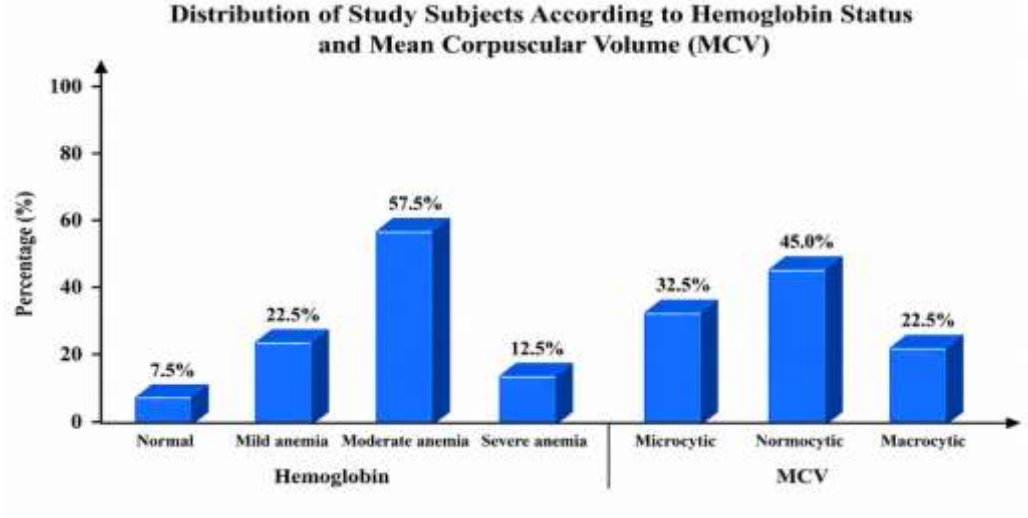


In the present study, anemia was the most common hematological manifestation, observed in 37 (92.5%) study subjects. Lymphopenia was present in 30 (75.0%) study subjects, followed by thrombocytopenia in 23 (57.5%) study subjects. Severe neutropenia was observed in 21 (52.5%) study subjects, while leucopenia was present in 14 (35.0%) study subjects.

Table 3. Distribution of Study Subjects According to Hemoglobin Status and Mean Corpuscular Volume (MCV)

Variable	Category	n	%
Hemoglobin	Normal	3	7.5
	Mild anemia	9	22.5
	Moderate anemia	23	57.5
	Severe anemia	5	12.5
MCV	Microcytic	13	32.5
	Normocytic	18	45.0
	Macrocytic	9	22.5

Graph 3. Distribution of Study Subjects According to Hemoglobin Status and Mean Corpuscular Volume (MCV)



In the present study, the majority of study subjects had moderate anemia, accounting for 23 (57.5%) subjects, followed by mild anemia in 9 (22.5%) subjects and severe anemia in 5 (12.5%) subjects. Only 3 (7.5%) study subjects had normal hemoglobin levels.

With respect to mean corpuscular volume (MCV), normocytic morphology was the most common, observed in 18 (45.0%) study subjects, followed by microcytic morphology in 13 (32.5%) study subjects, while macrocytic morphology was present in 9 (22.5%) study subjects.

Table 4. Association of Hematological Manifestations with WHO Clinical Stage Among the Study Subjects

Manifestation	Stage I	Stage II	Stage III	Stage IV	p value
Anemia	2	18	7	1	0.055
Thrombocytopenia	1	16	5	1	0.072
Leucopenia	2	7	4	1	0.371
Lymphopenia	7	18	4	1	0.149
Severe neutropenia	1	11	8	1	**0.005**

In the present study, anemia was observed in 2 subjects with WHO Stage I, 18 subjects with Stage II, 7 subjects with Stage III, and 1 subject with Stage IV ($p = 0.055$). Thrombocytopenia was present in 1 subject with Stage I, 16 subjects with Stage II, 5 subjects with Stage III, and 1 subject with Stage IV ($p = 0.072$). Leucopenia was observed in 2 subjects with Stage I, 7 subjects with Stage II, 4 subjects with Stage III, and 1 subject with Stage IV ($p = 0.371$). Lymphopenia was present in 7 subjects with Stage I, 18 subjects with Stage II, 4 subjects with Stage III, and 1 subject with Stage IV ($p = 0.149$). Severe neutropenia was observed in 1 subject with Stage I, 11 subjects with Stage II, 8 subjects with Stage III, and 1 subject with Stage IV ($p = 0.005$).

Table 5. Association of Hematological Manifestations with CD4 Count Among the Study Subjects

Manifestation	CD4 <200	CD4 ≥200	p value
Anemia	25	12	0.563
Leucopenia	13	1	**0.007**
Thrombocytopenia	22	1	**<0.001**
Lymphopenia	19	11	0.702
Severe neutropenia	20	1	**<0.001**

In the present study, anemia was observed in 25 study subjects with CD4 count <200 cells/mm³ and 12 study subjects with CD4 count ≥200 cells/mm³ ($p = 0.563$). Leucopenia was present in 13 study subjects with CD4 count <200 cells/mm³ and 1 study subject with CD4 count ≥200 cells/mm³ ($p = 0.007$). Thrombocytopenia was observed in 22 study subjects with CD4 count <200 cells/mm³ and 1 study subject with CD4 count ≥200 cells/mm³ ($p < 0.001$). Lymphopenia was present in 19 study subjects with CD4 count <200 cells/mm³ and 11 study subjects with CD4 count ≥200 cells/mm³ ($p = 0.702$). Severe neutropenia was observed in 20 study subjects with CD4 count <200 cells/mm³ and 1 study subject with CD4 count ≥200 cells/mm³ ($p < 0.001$).

DISCUSSION

The present study evaluated the hematological manifestations among newly detected human immunodeficiency virus (HIV)-infected subjects and demonstrated that hematological abnormalities were highly prevalent at the time of diagnosis. Anemia was the most common abnormality, followed by lymphopenia, thrombocytopenia, severe neutropenia, and leucopenia. Most patients belonged to WHO clinical stage II and had CD4 counts below 200 cells/mm³, indicating significant immunosuppression even at initial presentation.

In the present study, anemia was observed in 92.5% of subjects, with moderate anemia being the most frequent pattern. This finding is consistent with the observations of Damtie et al. (2021) and Duguma et al. (2021), who reported anemia as the predominant hematological abnormality among HIV-infected adults before initiation of highly active antiretroviral therapy (HAART) (2,5). Volberding (2002) emphasized that anemia is one of the most clinically significant hematological complications of HIV infection because it adversely affects quality of life, functional status, and survival (6). The high prevalence of anemia in the present study may be attributed to bone marrow suppression, chronic inflammation, nutritional deficiencies, and the direct effects of HIV infection.

The morphological evaluation of anemia in the present study showed that normocytic anemia was the most common pattern, followed by microcytic and macrocytic anemia. These findings are in agreement with Opie et al. (2024), who reported that normocytic normochromic anemia is frequently encountered in HIV infection due to chronic disease and impaired erythropoiesis (3). Kolarš et al. (2025) further highlighted that nutritional deficiencies, particularly iron deficiency, can contribute to microcytic anemia, whereas vitamin deficiencies and bone marrow dysfunction may account for macrocytosis in HIV-infected individuals (12).

Leucopenia was identified in 35% of subjects, while lymphopenia and severe neutropenia were observed in 75% and 52.5% of cases, respectively. Similar hematological abnormalities were reported by Damtie et al. (2021) and Duguma et al. (2021), who found that reductions in white blood cell counts become increasingly common as HIV disease progresses (2,5). Tsukamoto (2020) explained that HIV affects hematopoietic stem and progenitor cells, leading to impaired production of leukocytes and other blood cell lineages (4). Additionally, Shanafelt and Fonseca (2024) described neutropenia as an important complication

predisposing HIV-infected individuals to bacterial and opportunistic infections (7).

Thrombocytopenia was present in 57.5% of the study population. This observation is comparable to the findings of Opie et al. (2024), who noted that thrombocytopenia remains a common hematological manifestation in HIV infection because of immune-mediated platelet destruction and impaired platelet production (3). The substantial frequency of thrombocytopenia in the present study highlights the importance of routine platelet count assessment in newly diagnosed patients.

The present study also demonstrated that severe neutropenia showed a significant association with WHO clinical stage ($p=0.005$), while leucopenia, thrombocytopenia, and severe neutropenia were significantly associated with CD4 counts below 200 cells/mm³. Similar observations were reported by Damtie et al. (2021) and Duguma et al. (2021), who found that worsening immunosuppression is associated with increasing hematological abnormalities (2,5). Furthermore, M et al. (2025) reported that hematological markers correlate with immune status and may serve as useful indicators of disease severity in people living with HIV (9). Overall, the findings of the present study support the current understanding that hematological abnormalities are common in newly diagnosed HIV-infected individuals and become more pronounced with advancing immunosuppression. As highlighted by Lindegger (2024), early diagnosis and timely initiation of appropriate HIV therapy are essential to reduce disease-related complications (1). Routine hematological evaluation should therefore form an integral component of the initial assessment of HIV-infected patients to facilitate early detection and management of these potentially reversible abnormalities.

CONCLUSION

The present study demonstrated that hematological abnormalities are highly prevalent among newly detected human immunodeficiency virus (HIV)-infected subjects. Anemia was the most common hematological manifestation, followed by lymphopenia, thrombocytopenia, severe neutropenia, and leucopenia. Moderate anemia and normocytic anemia were the predominant hematological patterns observed. Most participants belonged to WHO clinical stage II and had CD4 counts below 200 cells/mm³, indicating significant immunosuppression at the time of diagnosis. Severe neutropenia showed a significant association with WHO clinical stage, while leucopenia, thrombocytopenia, and severe neutropenia were significantly associated with lower CD4 counts, highlighting the relationship between hematological abnormalities and immune status. These findings emphasize the importance of routine hematological evaluation in all newly diagnosed HIV-infected individuals. Early identification and timely management of hematological abnormalities, along with prompt initiation of antiretroviral therapy, may help reduce complications, improve clinical outcomes, and enhance the overall quality of care for people living with HIV.

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