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Research Article

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Hematological Profile of Individuals Living with HIV/AIDS: Comprehensive Study

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ABSTRACT

Background: HIV/AIDS patients often experience hematological abnormalities like anemia, thrombocytopenia, neutropenia, and leukopenia, which require understanding for effective care and management. Therefore, the present research was designed to study the hematological profile of people living with HIV/AIDS (PLHA).

Methods: A study involved 120 inpatient and outpatient patients who underwent comprehensive clinical, hematological, radiological, and microbiological investigations. Patients were given two blood samples for CD4 count analysis and hematological parameters assessment. Hematologic values were calculated based on specific cutoffs, including anemia (Hb<13% for men and Hb<12 gm% for non-pregnant women), thrombocytopenia (platelet count <1.5 lakh/mm^3), and leucopenia (white blood cell count <4000/mm^3). Mean corpuscular volume, hemoglobin, and concentration assessments were also conducted.

Results: The study involved 120 patients, with 53.3% being male and 46.7% female. The mean corpuscular volume (MCV) was the highest, with a maximum of 38.3% in the 80-100 fml range, indicating anemia. The mean corpuscular hemoglobin (MCH) was the most common, with 55% having MCH between 27-32 picogm. The mean corpuscular haemoglobin concentration (MCHC) was the most common, with 52.5% having MCHC between 31-35%. The highest rectic count was 93.3%, with a TLC between 4000-11000/Cumm (94.2%). The study also showed that 49.2% of patients had normocytic normochromic anaemia, 17.5% had microcytic hypochromic anaemia, and 25% had macrocytic anaemia. Furthermore, various haematological parameters showed statistically significant associations with CD4 count levels among individuals studied.

Conclusion: Hematological abnormalities, including anemia, are prevalent in patients with PLHA, contributing to their morbidity. Although ART may be responsible for anemia, the study found all patients on ART, making it difficult to prove this definitively. Identifying and correcting these abnormalities is crucial for improving patients' quality of life.

Key-words: ART, CD4 count, Hematological abnormalities, Haematological parameters, HIV/AIDS

INTRODUCTION

The term "AIDS" refers to acquired immunodeficiency syndrome, which is brought on by the human immunodeficiency virus (HIV). This retrovirus weakens the immune system and makes a person susceptible to various potentially fatal opportunistic infections, neurological conditions, and uncommon cancers. The HIV-1 and HIV-2 viruses, which are members of the primate lentivirus family, are the two known varieties of this virus [1].

Numerous hematological manifestations might result in symptoms that are potentially fatal and lower the patients' quality of life. Anemia, neutropenia, thrombocytopenia, venous thromboembolism, hemophagocytic syndrome, AIDS-related lymphomas, such as primary effusion lymphoma, Castlemann's disease, and infrequently Hodgkin's disease and myeloma, are examples of hematologic abnormalities caused by HIV infection. Anemia is widespread in people living with HIV; it affects 10–20% of patients at first and

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is identified in 70–80% of cases throughout the illness [2-4].

HIV infection results in CD8 cell dysfunction by reducing the number of CD4 cells in lymphoid organs and peripheral blood. For this reason, measuring CD4 helper cells is crucial for HIV patient staging and follow-up [5]. Granulocytopenia is the result of decreased CD4 cell numbers in HIV infection. Sepsis and mortality can occur when granulocyte numbers drop below 500 per mm^3 and there is accompanying damage to the anatomical barrier caused by the viral infection. This allows germs to enter the bloodstream and cause disease more quickly. Bacteria and their toxins can infiltrate the connective tissues and systemic circulation through the periodontal tissues in the mouth, which may operate as a weak barrier [6].

To evaluate HIV treatment and prognosis, hematological markers are crucial monitoring tools. Determining the precise degree of hematological alterations in HIV patients is vital as it will enable a comprehensive treatment plan and enhance their quality of life. Depending on the combination chosen, antiretroviral medication use may have a favorable or detrimental impact on these parameters [7]. The goal of the current study is to examine the hematological profile of individuals affected by HIV/AIDS.

MATERIALS AND METHODS

This prospective cohort study was conducted at the ART (Assisted Reproductive Technology) centre and the Department of General Medicine at GR Medical College in Gwalior, Madhya Pradesh, India. The study lasted from 1st January 2018 to 30th August 2019.

Inclusion criteria- The study included individuals above the age of 18 years who have given their consent to be registered at the ART centre, newly diagnosed patients with HIV/AIDS, previously diagnosed patients with HIV/AIDS who have not yet started Antiretroviral Therapy (ART) and previously diagnosed patients with HIV/AIDS, who are already on ART treatment.

Exclusion criteria- Individuals with a history of haematopoietic disorders or hematological malignancies before the diagnosis of HIV/AIDS, with a history of chronic kidney disease, chronic inflammatory disease, recent blood loss, or recent surgery, individuals with a history of using certain drugs known to cause hematological disorders and individuals, who do not provide informed consent for participation were excluded from the study.

Methodology- 120 patients were selected from both inpatients and outpatients. These patients had all undergone comprehensive clinical, hematological, radiological, and microbiological investigations at registration. Besides routine biochemical tests, each patient had two blood samples carefully withdrawn in a vacutainer using universal precautions. One sample was used for CD4 count analysis, while the other was utilized for assessing hematological parameters. The prevalence of different hematologic values was calculated based on specific cutoffs: anemia was defined as Hb<13% for men and Hb<12 gm% for non-pregnant women; thrombocytopenia was identified as platelet count <1.5 lakh/mm^3; leucopenia was determined by white blood cell count <4000/mm^3. Additionally, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), and peripheral blood smear assessments were also conducted.

Statistical analysis- IBM SPSS version 20 was used for all data analysis. Tables were prepared using frequency distribution and cross tabulation; categorical data was expressed as percentage; graphs were created using PRISM and Microsoft Office; the categorical data was compared using the Chi-Square test; a p-value of less than 0.05 is deemed significant.

Ethical Approval- Before the commencement of the study, ethical approval was obtained from the institutional review board or ethics committee.

RESULTS

The study included 120 patients, with 53.3% being male and 46.7% female. Male individuals demonstrated greater involvement compared to female patients. The study had the highest participation rate (46.7%) among patients aged 31-40. The average age of the patients was 40±31.99 (Fig. 1 and 2).

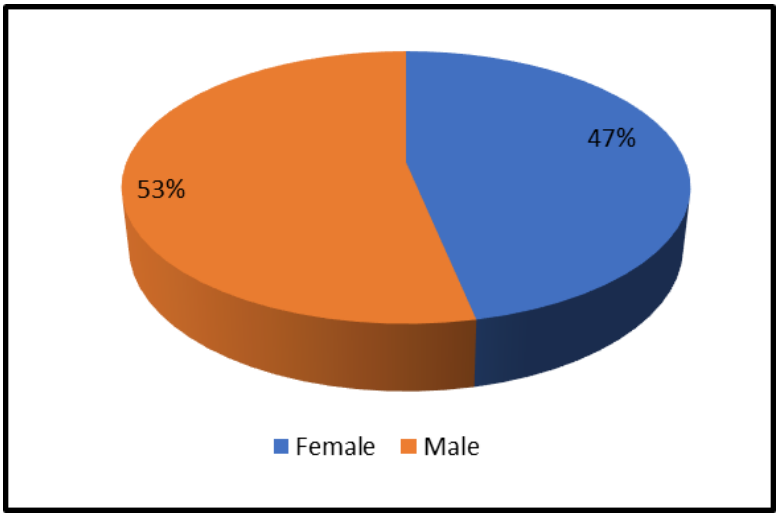

Fig. 1: Distribution of patients according to age.

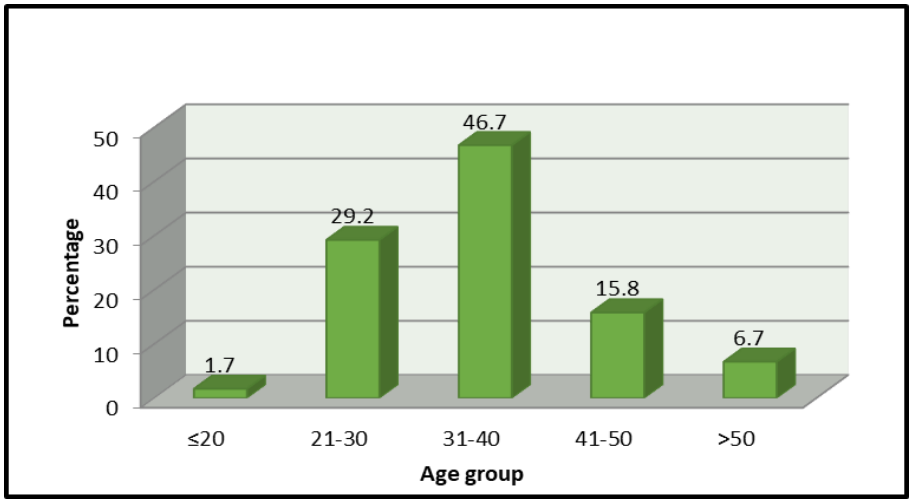

Fig. 2: Distribution of patients according to gender

Distribution of patients according to various haematological parameters is presented in fig. 3. RBC volume on average is represented by the mean corpuscular volume (MCV). The maximum MCV percentage of 38.3 was found in the 80–100 fml range in the current study, and it was observed that as the disease progressed, HIV-positive patients were more likely to become anemic. The average quantity of hemoglobin in each red blood cell is known as mean corpuscular hemoglobin or MCH. Most patients (55.2%) had MCH between 27 and 32 picogm, whereas 29.2% had MCH <27 picogm and 15.8% >32 picogm. Mean corpuscular haemoglobin concentration (MCHC) measures hemoglobin concentration in a red blood cell. In the present study, most patients had MCHC between 31-35% (52.5%) and, 45% of patients had MCHC <31% and only 2.5% had MCHC >35%. Rectic count, also known as reticulocyte count, measures the number of red blood cells the bone marrow produces and releases into the bloodstream. The patients with the highest rectic count value, 93.3%, were found in the 0.5–2% level, while 6.7% had the lowest value, <0.5% level. No patient's retic count was more than 2. In addition, most patients (94.2%) had TLC between 4000 and 11000/Cumm, 4.2% had TLC less than 4000/Cumm, and 1.7% had TLC greater than 11000/Cumm. Furthermore, 78.3% of the patients had a CD4 count below 500, whereas 21.7% had a CD4 level above 500.

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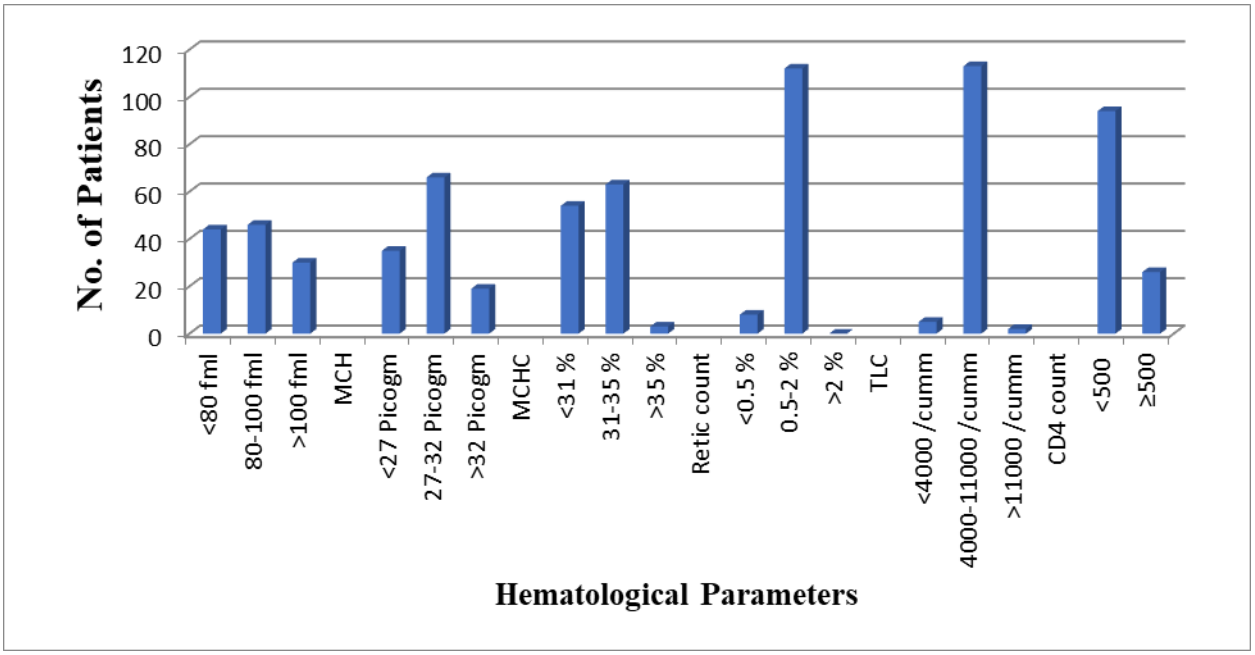

Fig. 3: Distribution of patients according to various haematological parameters.

The most prevalent type of anemia in the current study was normocytic normochromic, which accounted for 49.2% of patients; 17.5% of patients had microcytic hypochromic anemia, and the remaining 25% of patients had macrocytic anemia (Table 1).

Table 1: Distribution of patients according to anemia type

Anemia type	No of patients (%)
Normocytic Normochromica	59 (49.2)
Microcytic hypochromic	21 (17.5)
Macrocytic Anemia	30 (25)

Table 2 compares CD4 count with various haematological parameters. For MCV values less than 80 fL, 32 individuals with CD4 counts <500 cells/µl and 12 with CD4 counts ≥500 cells/µl. In the MCV range of 80-100 fL, were 36 individuals in the <500 group and 10 individuals in the ≥500 group. MCV values greater than 100 fL had 26 individuals with CD4 counts <500 cells/µl and 4 with CD4 counts ≥500 cells/µl. The calculated p-value for MCV was significant at 0.032, indicating a correlation between MCV levels and CD4 count. Individuals with MCH levels <27 picograms exhibited 32 cases in the CD4 count group <500, while only 3 cases were observed in the group with CD4 counts equal to or >500.

In the MCH range of 27-32 pg, there were 47 cases in the <500 group and 19 in the ≥500 group. For MCH values exceeding 32 pg, there were 15 cases in the <500 group and 4 cases in the ≥500 group. The calculated p-value for MCH was significant at 0.042, indicating a statistically meaningful relationship between MCH levels and CD4 count.

When MCHC was below 31%, there were 44 cases in the <500 group and 10 in the ≥500 group. In the 31-35% range, there were 47 cases in the <500 group and 16 cases in the ≥500 group. MCHC values above 35% had only 3 cases, all in the <500 group. The p-value for MCHC was not significant at 0.236. For TLC values <4000 per cumm, there were 1 case in the <500 group and 3 cases in the ≥500 group. In the range of 4000-11000 per cumm, 91 cases were in the <500 group, while 22 cases were in the ≥500 group. For TLC values above 11000 per cumm, there was 1 case each in both groups. The p-value for TLC was highly significant at 0.002, indicating a strong association between TLC levels and the two groups based on the defined cutoff.

Table 2: Comparing CD4 count with different haematological parameters.

Parameters		CD4 count (Cells/µl)		p-value
		<500	≥500	
MCV (fml)	<80	32 (34%)	12 (46.2%)	0.032
	80-100	36 (38.3%)	10 (38.3%)	
	>100	26 (27.7%)	4 (15.4%)	
MCH (Picogm)	<27	32 (34%)	3 (11.5%)	0.042
	27-32	47 (50%)	19 (73.1%)	
	>32	15 (16%)	4 (15.4%)	
MCHC (%)	<31	44 (46.8%)	10 (38.5%)	0.236
	31-35	47(50%)	16 (61.5%)	
	>35	3 (3.2%)	0 (0)	
Retic count (%)	<0.5	5 (5.3%)	3 (11.5%)	0.021
	0.5-2	89 (94.7%)	23 (88.5%)	
TLC (per cumm)	<4000	2 (2.1%)	3 (11.5%)	0.002
	4000-11000	91 (96.8%)	22 (84.6%)	
	>11000	1 (1.1%)	1 (3.8%)	

DISCUSSION

One of the most frequent side effects of HIV infection is hematological abnormalities. It has been established that hematological abnormalities are reliable, independent indicators of morbidity and death in HIV-positive people. As the illness worsens, these anomalies get worse. Many kinds of hematological abnormalities are common in both antiretroviral-treated and untreated people [8].

The majority of patients in the current study (46.7%) were between the ages of 31-40, followed by 29.2% of those between the ages of 21-30. Patients aged 41 and 50 comprised 15.8% of the total, while patients over 50 made up 6.7%. In a similar study, Katemba *et al.* studied 41 HIV-positive ART-naive patients. Their mean age was 34 years (95% CI=33, 36 years); the minimum and maximum ages were 17 and 63 years, respectively, with a median age of 32 years. The majority of patients were in the age group of 28-37 (36.88%) years, followed by 38-47(29%) years [9]. Similar findings were observed in a different study by Kathuria *et al.* with patients aged 18 to 64. The majority of patients (59%) were in the age range of 21 to 40. The patients' average age was 37.3±12.4 years [10].

According to a comparable study by Dikshit *et al.* the mean age of 200 HIV-positive people was 36.6±8.7 years [11], whereas a study by Dhal *et al.* indicated that the mean age of HIV patients was 36.85±6.2 years [12].

The current study found a 53.3% male preponderance and a 46.7% female preponderance. According to a study by Thulasi *et al.*, there were 62% male HIV patients and 58% female patients [13]. Furthermore, in a study by Saha *et al.,* 57.33% of HIV patients with anemia were female [14]. Ramraje *et al.,* in a study, discovered that the male-to-female ratio was 2.3:1, with 28 (70%) of the HIV patients being men and 12 (30%) being women [15]. Similarly, Ezeonwu *et al.* discovered that there were 33 females and 34 males among the youngsters who tested positive for HIV [16].

Most patients in the current study had MCV between 80 and 100 (38.3%), with 34% having MCV <80 and 27.7% having MCV >100. Most patients also had MCH between 27 and 32 (55%), 29.2% having MCH <27, and 15.8% having MCH >32. Furthermore, most patients had MCHC between 31 and 35 (52.5%), with 45% having MCHC <31 and only 2.5% having MCHC >35. In the study conducted by Kusfa *et al.* the mean (±SD) value of mean corpuscular

hemoglobin (MCH) in HIV patients was reported (26.3±2.93 vs 27.5±3.44pg, 95% CI; −1.7713,−0.5030, p value<0.001) [17].

In the current study, most patients (96.8%) had TLC between 4000 and 11000, 2.1% had TLC <4000, and 1.1% had TLC >11000. Similar findings were seen in the study by Kathuria *et al.*, where 15 patients (30%) had TLC >4000/cumm and 35 patients (70%) had TLC <4000/cumm [10]. According to research by Enawgaw *et al.* leucopenia (TLC <4000/cumm) was present in 20.8% of patients and 26.6% of controls, respectively [18]. On the other hand, Mathews *et al*. found that only 5.88% of cases had leucopenia cases (TLC <4000/cumm). Variations in study populations, clinical settings, and study design techniques could account for this discrepancy [19]. Leucopenia occurred slightly more frequently in patients on ART (15/25=60%) as compared to those not on ART (10/25=40%) in the investigations by Wanjari *et al.* and Enawgaw *et al.* [18,20]. Out of 100 HIV patients, 57 patients in the Kumar *et al.* study had TLC between 4000 and 11000; 35 patients had TLC <4000, and only eight patients had TLC >11000, similar to our study's findings [21].

Additionally, 78.3% of the patients had a CD4 count <500, whereas 21.7% had a level >500. Similar findings were found in the study by Katemba *et al.*, which included 141 HIV patients. Of them, 139 (98.58%) had CD4 counts (/L) < 500, and 2 (1.42%) had CD4 levels ≥500 [9]. In contrast, the median CD-4 count in the Shruthi *et al.* study was 89 cells/microliter. The CD4 count of all 100 HIV patients (100%) was less than 500/microliter. CD4 counts exceeded 500 in NP patients [22]. Dhal *et al.,* in their investigation, found that every patient had a CD4 count of <500/microliter [12]. In the study of Wankah *et al.*, out of 81 HIV patients 65 (80.3%) patients had CD4 count <500 and only 16 (19.7%) had CD4 count ≥500 [23].

LIMITATIONS

The current study has some limitations, including a limited sample size. We considered this a pilot study, and it should be expanded into a more extensive study with a case and control group drawn from the sample. This study excludes the most common hematological abnormalities observed in HIV patients; we were unable to determine the exact source of such abnormalities in our patients.

CONCLUSIONS

Hematological abnormalities are prevalent in PLHA. Anemia and other haematological abnormalities may contribute to the morbidity of PLHA. Sometimes ART may be responsible for anemia, but in our study, all patients were on ART. Hence, this could not be conclusively proven. However, the most common type of anemia is normocytic normochromic anemia. Proper efforts should be made to identify and correct haematological abnormalities in PLHA patients to improve their quality of life.

CONTRIBUTION OF AUTHORS

Research concept- Jitendra Satpute, Shweta Sahai
Research design- Jitendra Satpute, Balwant Patle
Supervision- Shweta Sahai
Materials- Jitendra Satpute, Shweta Sahai
Data collection- Jitendra Satpute, Shweta Sahai
Data analysis and Interpretation- Jitendra Satpute, Shweta Sahai
Literature search- Jitendra Satpute, Balwant Patle
Writing article- Jitendra Satpute, Shweta Sahai
Critical review- Shweta Sahai
Article editing- Jitendra Satpute, Balwant Patle
Final approval- Shweta Sahai

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