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Original Research Article

Exploration of Hematological Parameters in HIV-Infected Individuals: an Insight into Immune Dysfunction

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Abstract:

Introduction: Hematological abnormalities are common among HIV-infected individuals. This study aims to comprehensively evaluate hematological parameters in HIV-infected individuals.

Methods: A prospective cross-sectional study was conducted at GSL Medical College, Rajamahendravaram, from January to May 2016. Ethical approval was obtained, and informed consent was acquired from eligible participants. HIV-infected individuals meeting NACO criteria were enrolled. Comprehensive physical examinations and sociodemographic data collection were followed by blood sample collection. HIV status was determined per NACO guidelines, and hematological parameters were assessed using automated methods. Statistical analysis via SPSS software included descriptive statistics and ANOVA/t-tests. The study aimed to elucidate the hematological profile of HIV-infected individuals, offering insights for clinical management and interventions.

Results: In this study of 164 participants, predominantly male, several hematological parameters were compared between test (HIV-infected) and control groups. Eosinophil, basophil, and RDW counts were higher in the test group, while hematocrit, MCV, MCH, MCHC, and platelet counts were lower ($p < 0.05$). No significant difference was observed in monocyte count or mean platelet volume. These findings underscored distinct hematological profiles between HIV-infected and control individuals, emphasizing the significance of these parameters in HIV-related pathology.

Conclusion: Hematological abnormalities are common in HIV infection, persisting even after highly active antiretroviral therapy initiation (HAART). Effective management necessitates regular monitoring, early HAART initiation, and further longitudinal studies to understand and address associated risk factors, ultimately improving the overall care and outcomes for HIV-infected individuals.

Keywords: HIV infection, Hematological abnormalities, Anemia, Inflammatory markers.

Introduction

Human Immunodeficiency Virus (HIV) infection continues to pose a significant global health challenge, affecting approximately 38 million people worldwide according to recent estimates by the World Health Organization (WHO). [1] While the introduction of antiretroviral therapy (ART) has dramatically improved the prognosis and life expectancy of individuals living with HIV, the virus still exerts a profound impact on various physiological systems, including the hematological system.

Hematological abnormalities are common among HIV-infected individuals and can manifest across a spectrum of blood cell lineages, including red blood cells, white blood cells, and platelets. [2] These abnormalities often serve as indicators of disease progression, immune dysfunction, and the potential for opportunistic infections (OIs). Understanding the nature and implications of these hematological alterations is crucial for optimizing the management and care of HIV-infected individuals.

The hematological profile of HIV-infected individuals is characterized by several notable features. Anemia, is one of the most prevalent hematologic complications observed in this population. It can result from various factors, including chronic inflammation, OIs, bone marrow suppression due to HIV itself or certain antiretroviral medications, and nutritional deficiencies. [3]

Furthermore, alterations in white blood cell counts, particularly a decrease in CD4+ T-lymphocytes, are hallmark features of HIV infection. CD4+ T-cell depletion compromises the immune system's ability to mount an effective response against pathogens, predisposing individuals to OIs and malignancies. [4] Conversely, an increase in total white blood cell

count, often driven by chronic immune activation and inflammation, is also observed in HIV infection and is associated with disease progression and poorer clinical outcomes. Platelet abnormalities, including thrombocytopenia (reduced platelet count), are also prevalent in HIV-infected individuals. Thrombocytopenia may result from HIV-associated immune thrombocytopenic purpura (ITP), bone marrow suppression, or co-infections such as hepatitis C virus (HCV) or OIs.

In addition to these primary hematological alterations, HIV infection can impact various other parameters, including coagulation factors, serum iron levels, and erythropoietin production, contributing to a complex interplay of pathophysiological mechanisms. This study aims to comprehensively evaluate hematological parameters in HIV-infected individuals, this research also endeavor strives to enhance the quality of care and management strategies for this vulnerable population.

Methods

A prospective cross-sectional study was conducted at the Physiology Department of GSL Medical College, Rajamahendravaram, spanning from January to May 2016. Ethical approval was obtained from the Institutional Ethics Committee, and informed written consent was acquired from all eligible participants. The study enrolled individuals aged over 18 years, of both genders, who met the criteria for HIV infection as per the National AIDS Control Organization (NACO) guidelines. Pregnant women, non-cooperative individuals, and those currently under medication were excluded from the study to ensure the integrity of the research.

Upon enrollment, participants received a detailed explanation of the study's objectives, and any queries or concerns were addressed comprehensively. Assurances were given regarding the non-interference of the study protocol with their health status, and strict confidentiality measures were implemented to safeguard their privacy.

Following initial procedures, a thorough physical examination was conducted, and all pertinent observations were diligently recorded in the study documentation. Sociodemographic data, including age, gender, economic status, educational background, and occupation, were also documented for each participant. Subsequently, blood samples were collected using universal safety precautions to minimize any potential risks associated with the procedure. All the HIV individuals were included in test group and healthy ones in control group.

HIV status was determined according to NACO guidelines, with adherence to manufacturer specifications to ensure accuracy and reliability of results. Additionally, haematological parameters were assessed using an automated method, following established institutional protocols.

Statistical analysis of the collected data was performed using SPSS software version 17. Descriptive statistics such as mean and standard deviation were calculated to summarize the characteristics of the study population. Analysis of variance (ANOVA) and t-tests were employed to compare variables of interest between different groups. A significance level of $p < 0.05$ was considered statistically significant, indicating a meaningful difference or association between variables under investigation.

Through meticulous data collection and rigorous statistical analysis, this study aimed to elucidate the hematological profile of HIV-infected individuals, contributing valuable insights into the impact of the virus on various blood parameters and facilitating informed decision-making in clinical management and intervention strategies.

Results

In this study, total 164 members were included. Majority were male members. The mean (5.25 ± 3.2 vs. 2.4 ± 1.1) eosinophil count, mean (0.34 ± 0.5 vs. 0.08 ± 0.2) basophil count, mean (14.9 ± 2.3 vs. 13.5 ± 1.1) red cell distribution width (RDW) is higher in the test group. The mean hematocrit (HCT) level is lower in the test group; 32.07 ± 6.0 vs. 40.2 ± 4.3. Mean corpuscular volume (MCV) (79.3 ± 10.5 vs. 85.4 ± 4.7), mean corpuscular hemoglobin (MCH) (26.0 ± 4.2 vs. 29.7 ± 2.6), mean corpuscular hemoglobin concentration (MCHC) (32.9 ± 2.0 vs. 34.4 ± 2.3), mean platelet counts (2.43 ± 0.96 vs. 3.18 ± 0.37) were lower in the test group; statistically there was significant difference between the groups, respectively in the parameter. Whereas there was no significant difference in the mean monocyte count (MMC) mean platelet volume (MPV) between the groups.

Discussion

HIV infection is a complex condition affecting multiple bodily systems, with hematological abnormalities emerging as prevalent clinicopathological features. These complications often play a pivotal role in the morbidity and mortality of HIV-infected individuals. [5] Hematological disturbances encompass a spectrum of issues, including compromised hemopoiesis, immune-mediated cytopenias, and coagulopathies, which tend to escalate as the disease progresses. These manifestations not only reflect the direct impact of the virus on blood cell production but also signify underlying immune dysfunction and heightened susceptibility to opportunistic infections. Furthermore, coagulation abnormalities, particularly in advanced stages of the disease, pose significant challenges in the clinical management of

HIV-infected patients. Understanding and addressing these hematological complexities are essential for improving outcomes and enhancing the quality of care for individuals living with HIV. [6, 7]

In HIV individuals, MCV holds significance as it reflects morphological changes in red blood cells, indicating potential anemia. In our study, the mean MCV was 79.3. Comparable findings were reported by Tripathi et al. [8] and Daniel Nii Aryee Tagoe and Evelyn Asantewaa. [9] Our study revealed that 53% of cases had MCV within the normal range, indicating normocytic RBC, while 43.9% had MCV <80, suggestive of microcytic RBCs. These findings underscore the prevalence of anemia, particularly microcytic, among HIV-positive individuals. Monitoring MCV levels can aid in assessing the severity and progression of anemia, guiding appropriate interventions to mitigate its impact on patient health and quality of life. The mean MCH was 26.0 ± 4.2. Out of 164 cases, 63.4% had normal MCH, 33.5% had MCH < 26 pg and 3.1% had MCH > 32 pg. Similar findings were reported. [10, 11]

MCHC mean was 32.9 ± 2.0. Majority (87.2%) exhibited MCHC between 31-36%, indicating normochromasia. Parinitha et al. [12] found normocytic normochromic anemia most common (40.4%), followed by dimorphic anemia (18.8%), normocytic hypochromic (11.6%), microcytic hypochromic (7.2%), and macrocytic anemia (6%).

RDW, reflecting red blood cell size variability, aids in anemia and vitamin deficiency diagnosis and serves as a marker of inflammatory activity. In our study, mean RDW-CV was 14.9, denoting mild anisocytosis, consistent with Schneider et al.'s findings. [13] Prior research on HIV-positive patients noted elevated RDW, attributed to inflammatory-induced erythrocyte maturation impairment. [14] This exacerbates oxidative stress, potentially heightening cardiovascular risk. Interestingly, our study revealed RDW's significant association with MCV and MCH ($P < 0.001$), underscoring its diagnostic relevance. Prior studies similarly highlighted RDW's susceptibility to alteration in HIV-positive cases, implicating its utility as a hematological marker.

Monocytes play a vital role in both acute and chronic inflammation, contributing to the initiation and perpetuation of inflammatory responses. Their involvement extends to inflammation-related diseases like atherosclerosis, suggesting their significance in the pathogenesis of such conditions. [15, 16] Similar to our study findings, there was no statistical difference in the MMC in the reports. [17]

Conclusion

Hematological abnormalities are common in HIV infection, persisting even after highly active antiretroviral therapy initiation (HAART). Effective management necessitates regular monitoring, early HAART initiation, and further longitudinal studies to understand and address associated risk factors, ultimately improving the overall care and outcomes for HIV-infected individuals.

References

1. Kumah E, Boakye DS, Boateng R, Agyei E. Advancing the Global Fight Against HIV/Aids: Strategies, Barriers, and the Road to Eradication. Ann Glob Health. 2023; 89(1): 83.
2. Tilahun M, Gedefie A, Ebrahim E, Seid A, Ali A, et al. Immuno-Haematological Abnormalities of HIV-Infected Patients Before and After Initiation of Highly Active Antiretroviral Therapy in the Antiretroviral Therapy Clinics of Six Health Facilities at Dessie Town, Northeast Ethiopia. J Blood Med. 2022; 13: 24 3 – 53.
3. 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; 44:101283.
4. Govindaraj S, Babu H, Kannanganat S, Vaccari M, Petrovas C, Velu V. Editorial: CD4+ T cells in HIV: A Friend or a Foe? Front Immunol. 2023;14: 1203531.
5. Berhan A, Bayleyegn B, Getaneh Z. HIV/AIDS Associated Lymphoma: Review. Blood Lymphat Cancer. 2022; 12: 31 – 45.
6. Priceputu E, Cool M, Bouchard N, Caceres-Cortes JR, Lowell CA, Hanna Z, Jolicoeur P. HIV-1 Nef Induces Hck/Lyn-Dependent Expansion of Myeloid-Derived Suppressor Cells Associated with Elevated Interleukin-17/G-CSF Levels. J Virol. 2021; 95(17): e0047121.
7. Theron AJ, Anderson R, Rossouw TM, Steel HC. The Role of Transforming Growth Factor Beta-1 in the Progression of HIV/AIDS and Development of Non-AIDS-Defining Fibrotic Disorders. Front Immunol. 2017; 8: 1461.
8. Tripathi AK, Kalra P, Misra R, Kumar A, Gupta N. Study of bone marrow abnormalities in patients with HIV disease. J Assoc Physicians India. 2005; 53: 105 – 10.
9. Daniel Nii Aryee Tagoe and Evelyn Asantewaa. Profiling Haematological Changes in HIV patients attending fevers clinic at the central regional hospital in Cape Coast, Ghana: A case-control study. Archives of Applied Science Resea. 2011; 3 (5): 326 – 31.
10. John JDP, Kshetrimayum BS, Ningthoujam B, Ningthoukhongjam R, et al. Hematological profile of HIV-infected patients on first-line highly active antiretroviral therapy and its correlation with CD4 count. Int J of Rec Sur and Med Sci. 2021; 7 (2): 54 – 63.
11. Kaur J, Singh H, Sachdeva S, Kundal RK. Evaluation of Hematological Parameters in HIV Reactive Patients on Antiretroviral Therapy and

Treatment Naïve Patients: A Comparative Study. Ann. Int. Med. Den. Res. 2017; 3(3): PT38-PT43.
12. Parinitha S, Kulkarni M. Haematological changes in HIV infection with correlation to CD4 cell count. Australas Med J. 2012;5(3): 1 57 – 62.
13. Schneider DR, Picker LJ. Myelodysplasia in acquired immunodeficiency syndrome. Am J Clin Pathol 1985; 84(2): 144 – 52.
14. Owoicho O, Tapela K, Olwal CO, Djomkam Zune AL, Nganyewo NN, Quaye O. Red blood cell distribution width as a prognostic biomarker for viral infections: prospects and challenges. Biomark Med. 2022; 16(1): 41 – 50.
15. Wong ME, Jaworowski A, Hearps AC. Corrigendum: The HIV Reservoir in Monocytes and Macrophages. Front Immunol. 2019; 10: 2517.
16. White KS, Walker JA, Wang J, Autissier P, Miller AD, Abuelezan NN, Burrack R, Li Q, Kim WK, Williams KC. Simian immunodeficiency virus-infected rhesus macaques with AIDS co-develop cardiovascular pathology and encephalitis. Front Immunol. 2023; 14:124 0946.
17. Knudsen AD, Bouazzi R, Afzal S, et al. Monocyte count and soluble markers of monocyte activation in people living with HIV and uninfected controls. BMC Infect Dis. 2022; 22: 451.