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RESEARCH ARTICLE

DERANGEMENTS OF HEMATOLOGICAL PARAMETERS ASSOCIATED WITH ASPECTS OF HIV INFECTION

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ABSTRACT

Background: Hematological derangements are among the common complications associated with HIV infection. HIV infection may affect any cell line causing, anemia, thrombocytopenia, and leucopenia or may cause pancytopenia.
Patients and Materials: This study was conducted at Pakistan Institute of Medical Sciences, Islamabad from March 2017 to June 2017. Patients were diagnosed as HIV positive as per WHO criteria. Detailed medical history, physical examination, and investigations were conducted. Data was collected and analyzed on SPSS version 21.0.
Results: Total 92 patients were selected for the study. Patients were divided into two groups. Group A consists of 48 control patients. Group B consists of 44 HIV – positive patients. Majority of patients belonged to reproductive age group (16 – 45 years) in both groups. Male to female ratio was higher (3:1) in both groups. Common clinical features among patients were fever (85%), weight loss (73%), anemia (35%) and oral thrush (19%) in Group B.
Conclusion: Hematological abnormalities were present in presence of HIV infection as compared to control group. This may has significant effect on clinical outcome of the disease. So all the HIV-positive patients should be investigated for routine hematological evaluation.

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INTRODUCTION

Human immunodeficiency virus (HIV) is the cause of acquired immunodeficiency syndrome (AIDS). It is diagnosed either by presence of opportunistic infection or CD4+ counts less than 200 per microlitre or sometimes combination of both. Hematological aspects of human immunodeficiency virus (HIV) are common and are responsible for life – threatening symptoms and may impair the quality of life of patients (Sanjeevan, 2006). Abnormalities of hematological parameters are among the common complications of infection with human immunodeficiency virus (HIV). This infection may affect one or all cell lines of blood cells. Cell lines are affected by both qualitative and quantitative defects (Kotwal, 2013 and Ibeh, 2013). Human immunodeficiency virus (HIV) duplicated not only in CD4 lymphocyte cells, but also in macrophage and dendritic cells. This duplication leads to depression of immune system which is responsible for life – threatening opportunistic infections.

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Common hematological abnormalities include anemia and neutropenia which are mainly caused by production of inadequate blood cells because of suppression of bone marrow by HIV infection mediated by abnormal cytokine expression and changes in bone marrow microenvironment (Munyazesa, 2012; Levine, 2001). Approximately 15% of asymptomatic carriers of HIV are suffered from mild anemia. Prevalence of anemia in early disease is about 30 – 40% which increases to 75 – 90% in advanced patients (Kumar, 2016). Anemia is the most common abnormalities associated with HIV infection with normocytic normochromic anemia being frequent, followed by microcytic anemia. Severity of anemia is related with severity of infection. Thrombocytopenia is found in 30 – 40% of patients with HIV infection and can occur at any stage during progression of disease. Chronic infection is a characterized etiology of chronic immune thrombocytopenic purpura. It is caused by immune – mediated platelet destruction by antibodies which cross reacts that are directed towards HIV proteins, namely gp120 and p24. Neutropenia is also common finding associated with HIV infection and is presented in 10 – 30% patients in advanced disease. Infection with HIV leads to bone marrow suppression and cause decreased levels of granulocyte colony – stimulating factor,

resulting in leucopenia and neutropenia. Other cause of neutropenia and leucopenia are myelosuppressive drugs and opportunistic infection by tuberculosis, cytomegalovirus, leishmaniasis and histoplasmosis. HIV infection can also direct results in lymphopenia by progression of disease which leads to decrease in CD4+ lymphocytes (Enawgaw, 2014; Ifeanyichukwu, 2016; Parinitha, 2012). The aim of this study is to evaluate different hematological parameters abnormalities in patients with HIV.

MATERIALS AND MATERIALS

Total 92 patients were included in the study and were divided into two groups. Group A consists of 48 normal control group and group B consists of 44 patients positive for HIV. This study was performed in Department of Medicine and Department of Pathology at Pakistan Institute of Medical Sciences Islamabad. Study was performed from March 2017 to June 2017. Inclusion criteria in both groups were patients of reproductive age. In group A normal healthy adults, negative for HIV, no significant medical history, no past medical history, no drug addiction, no bleeding disorder, no allergy or no co-morbid conditions were included in the study. In group B, patients positive for HIV infection, no co-morbid condition, no hematological disorder. not on any antiretroviral therapy were included. Detailed medical history, general and systemic examination were conducted from all patients. Complete blood count was measured using Sysmex X -100 automated analyzer. Absolute CD4+ count was measured by flowcytometry. Patient was labeled as anemic if hemoglobin level was less than 13g/dL (male) and <12 g/dL (female). Leucopenia was defined as total white blood cell count less than 4000 cells/µL. Neutropenia was defined when absolute neutrophil count <1000 cells/µL. Lymphopenia was defined when absolute lymphocyte count <800 cells/µL. Thrombocytopenia was defined as total platelet count less than 150 x 10^3/µL.

RESULTS

A total of 92 patients were included in the study (Figure 1). In control group, the age of patients was measured between 18 years to 42 years (Mean = 29.12 ± 10.2 years) (Table 1).

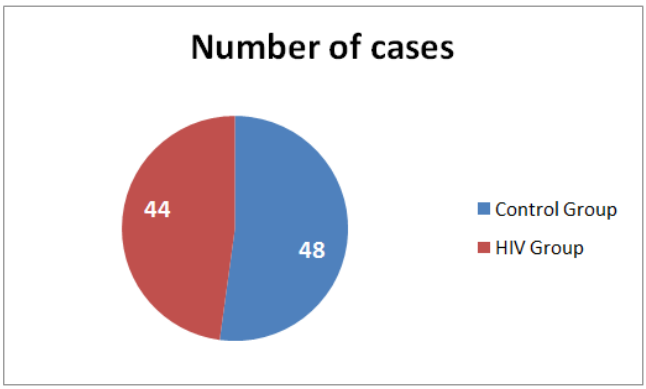

Figure 1. Number of cases

Table 1. Age distribution in both groups

	Control Group (n=48)	HIV Group (n=44)
Age	18 – 42	16 – 45

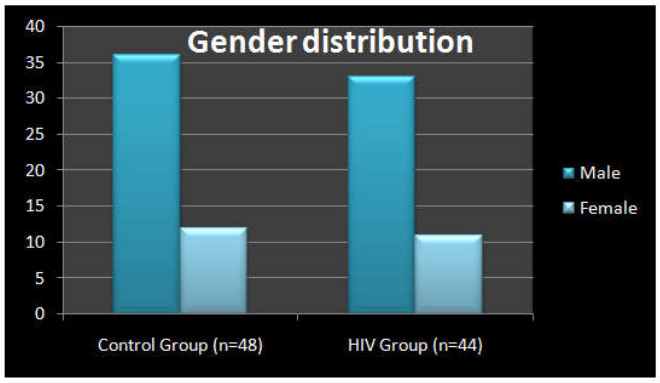

Figure 1. Gender distribution in both groups

Table 2. Gender discrimination in both groups

	Control Group (n=48)	HIV Group (n=44)
Male	36	33
Female	12	11

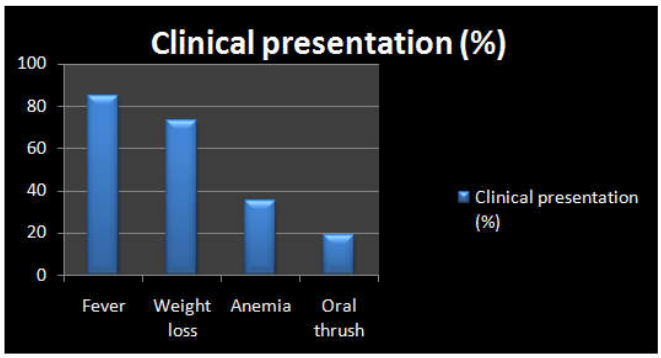

Figure 2. Clinical presentation in patients affected with HIV infection

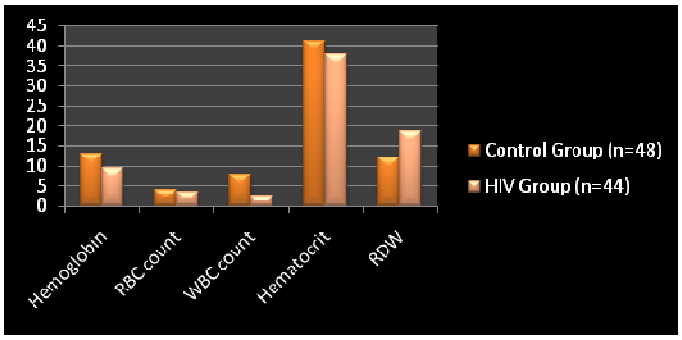

Figure 3. Hemoglobin, RBC count, WBC count, hematocrit and RDW in both groups

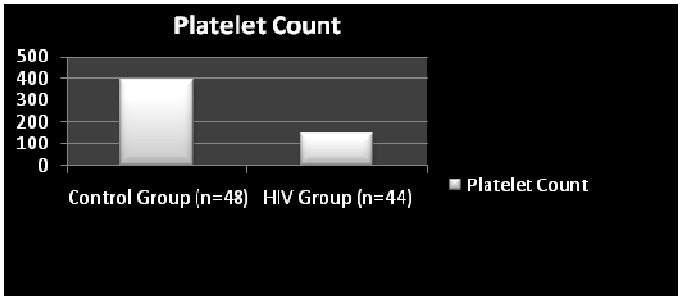

Figure 5. Platelet count in both groups

In HIV group, the age of patients was measured between 16 to 45 years (Mean = 30.38 ± 11.93 years). Age was not

statistically significant between two groups (p = 1.02) (Table 1). Male to female ratio was equal in both groups (3:1). In control group, 36 were male and 12 were female, while in HIV group, 33 were male and 11 were female (Figure 2, Table 2). Common clinical presentations among patients were fever (85%), weight loss (73%), anemia (35%), oral thrush (19%), thrombocytopenia (8%) and pneumonia (2%) (Figure 3). Hemoglobin concentration in control group was measured between 12.4 mg/dL to 15.8 mg/dL (Mean = 13.1 ± 2.13 mg/dL), while hemoglobin concentration in HIV group was found to be ranging between 7.12 mg/dL to 10.4 mg/dL (Mean = 9.29 ± 2.29 mg/dL). There was statistically significant difference in hemoglobin concentration in two groups (p = 0.021). Red blood cell count in control group was ranging between 3.81 million to 4.94 million (Mean = 4.10 ± 1.02 million), while in HIV group the red blood cell count was found to be between 3.01 million to 3.92 million (Mean = 3.34 ± 0.91 million).

count in control group ranged between 5.81 10^9/L to 8.21 10^9/L (Mean = 7.8 ± 2.94 10^9/L), while in HIV group white blood cell count was measuring between 1.89 10^9/L to 3.12 10^9/L (Mean = 2.31 ± 1.81 10^9/L). There was statistically significant difference of white blood cell count between two groups (p <0.001). Hematocrit in control group was between 39.1% to 45.8% (Mean = 41.1 ± 2.41%), while in HIV group it was measured between 35.5 to 40.23% (Mean = 37.8 ± 1.91). There was no statistically significant difference of hematocrit between two groups (p = 0.51) (Figure 4, Table 3, Table 4). Platelet count in control group was found to be between 252 x10^9/L to 458 x 10^9/L (Mean = 391 ± 128 x 10^9/L), while in HIV group it was measured between 104 x 10^9/L to 169 x 10^9/L (Mean = 149 ± 101 x 10^9/L). There was statistically significant difference in platelet count between two groups (p = 0.022) (Figure 5, Table 3, Table 4). Red cell distribution width in control group was found to be between 9.3% to 13.9% (Mean = 12.1 ± 1.81%), red cell distribution width in HIV

Table 3. Mean parametric difference in both groups

	Control Group (n=48)	HIV Group (n=44)	P – value
Hemoglobin concentration (mg/dL)	13.1 ± 2.13	9.29 ± 2.29	p = 0.021
Red blood cell count (million)	4.10 ± 1.02	3.34 ± 0.91	p = 0.34
White blood cell count (10^9/L)	7.8 ± 2.94	2.31 ± 1.81	p <0.001
Hematocrit (%)	41.1± 2.41	37.8 ± 1.91	p = 0.51
Platelets (10^9/L)	391 ± 128	149 ± 101	p = 0.022
Red cell distribution width (%)	12.1 ± 1.81	18.83 ± 3.12	p = 0.004
Reticulocyte count (10^9/L)	1.5 ± 0.83	0.7 ± 0.59	p = 0.92
CD4 + Countn (mm^3)	710 ± 105	61 ± 59	p <0.001

Table 4. Comparison of all parameters in both groups

	Control Group (n=48)	HIV Group (n=44)	P – value
Age (Years)	18 – 42 (Mean = 29.12± 10.2)	16 – 45 (Mean = 30.38 ± 11.93)	1.02
Hemoglobin (mg/dL)	12.4 – 15.8 (Mean = 13.1 ± 2.13)	7.12 – 10.4 (Mean = 9.29 ± 2.29)	0.021
Red blood cell count (million)	3.81 – 4.94 (Mean = 4.10 ± 1.02)	3.01 – 3.92 (Mean = 3.34 ± 0.91)	0.34
White blood cell count (10^9/L)	5.81 – 8.21 (Mean = 7.8 ± 2.94)	1.89 – 3.12 (Mean = 2.31 ± 1.81)	<0.001
Hematocrit (%)	39.1 – 45.8 (Mean = 41.1 ± 2.41)	35.5 – 40.23 (Mean = 37.8 ± 1.91)	0.51
Platelets (10^9/L)	252 – 458 (Mean = 391 ± 128)	104 – 169 (Mean = 149 ± 101)	0.022
Red cell distribution width (%)	9.3 – 13.9 (Mean = 12.1 ± 1.81)	16.6 – 21.4 (Mean = 18.83 ± 3.12)	0.004
Reticulocyte count (%)	0.7 – 1.9 (Mean = 1.5 ± 0.83)	0.1 – 1.2 (Mean = 0.7 ± 0.59)	0.92
CD4+ Count (%)	551 – 948 (Mean = 710 ± 105)	43 – 93 (Mean = 61 ± 59)	<0.001

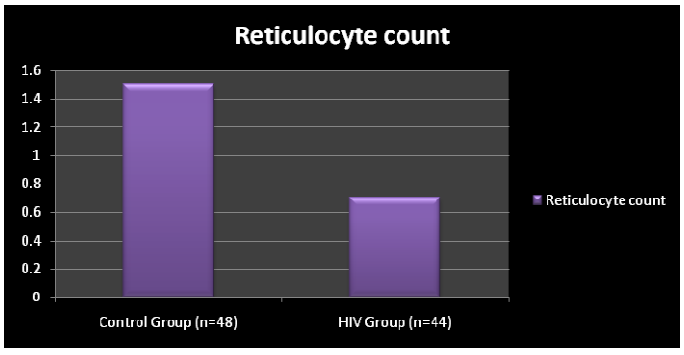

Figure 6. Reticulocyte count in both groups

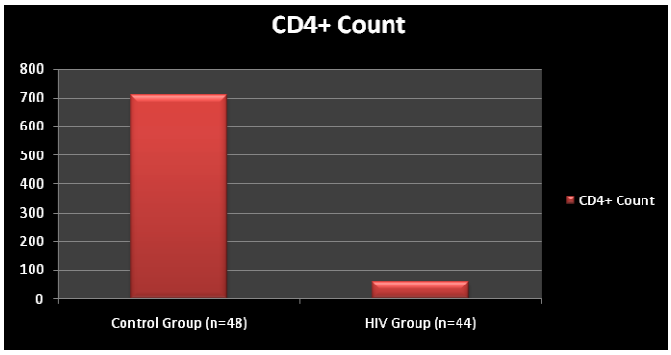

Figure 7. CD4+ count in both groups

There was not statistically significant difference of red blood cell count between two groups (p = 0.34). White blood cell

group was between 16.6% to 21.4% (Mean = 18.83 ± 3.12%). The difference of red cell distribution width was found to be

statistically significant (p = 0.004) (Figure 3, Table 3, Table 4). Reticulocyte count in control group was between 0.7% to 1.9% (Mean = 1.5 ± 0.83%), while in HIV group it was between 0.1% to 1.2% (Mean = 0.7± 0.59%). The difference of reticylocyte count was not statistically significant (p = 0.92) (Figure 6, Table 3, Table 4). CD4+ count in control group was found to be between 551 mm^3 to 948 mm^3 (Mean = 710 ± 105 mm^3), while in HIV group it was found to be between 43 mm^3 to 93 mm^3 (Mean = 61 ± 59 mm^3). The difference was statistically significant (p<0.001) (Figure 7, Table 3, Table 4).

DISCUSSION

Etiology and pathogenesis of anemia, neutropenia, thrombocytopenia or their combination in patients infected with human immunodeficiency virus is not fully understood as it is multifactorial (10). In vitro, the human immunodeficiency virus has been identified in myelomonocytic precursor cells (CD34) of bone marrow, suggesting of its invasion in the bone marrow and ultimately results in abnormal production of difference progenitor cells. Defects in function of helper lymphocytes are associated with myelosuppression caused by HIV. Defects in mature granulocytes, monocytes and lymphocytes cell series has also been identified in the presence of virus (11). In this study, the hemoglobin concentration was found to be significantly lower in patients infected with human immunodeficiency virus (HIV) as compared to control group suggesting of effect of human immunodeficiency virus (HIV) on bone marrow erythroid precursors cells production. White blood cell count and platelet counts were also decreased in patients affected from virus as compared to control group. Red blood cell count was lower in patients suffering from virus as compared to control group, although the difference was not statistically significant. White blood cell count was markedly decreased in virus – infected people with statistically significant difference. Hematocrit was on lower side in virus affected individuals but the difference was not significant. Platelet count was significantly lower in virus infected patients, suggesting their increase in bleeding tendency. Red cell distribution width (RDW) was significantly higher in virus affected individuals which is indicator of presence of different sizes of red blood cells (anisocytosis), which might be due to production of both mature and immature red blood cells by bone marrow precursor cells. There was no difference of reticulocyte count in both groups. CD4+ count was markedly reduced in HIV infected people due to lymphopenia. This evidence is suggestive of effect of virus on granulocyte and megakryocyte cell series. There was marked decrease in CD4+ helper T cells in virus – affected group which is highly indicator of its effect on lymphocyte cell series as well. Many studies have shown to be having similar results. Dikshit et al performed study on patients having human immunodeficiency virus. He found that anemia was the most common among the patients (65.5%) (12). Bhowmik et al showed in his study that patients suffering from human immunodeficiency virus had anemia, leucopenia, lymphopenia, eosinophilia and thrombocytopenia (13). Bamlaku et al also showed that anemia was common among HIV – infected individuals (14). Wondimeneh et al showed that HIV – infected individuals were having thrombocytopia, specially in those having decreased CD4+ helper T cells (15). By the effect of virus on different bone marrow precursor cells, there are increased tendencies to anemia, infection due to neutropenia and lymphopenia, and bleeding due to thrombocytopenia CD4+ count.

Conclusion

Human immunodeficiency virus (HIV) has shown to affect all cell series of bone marrow precursors cells leading to anemia, leucopenia and thrombocytopenia. All these deficiencies produce further complications in virus affected people. Although CD4+ count was reduced in virus affected individuals, it is used to monitor the counts and effect of treatment after giving antiretroviral therapy.

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