Original Article

Correlation between the Haematological Changes and CD4 Cells Counts in HIV Infected Patients

Jitendra Satpute[1], Balwant Singh Patle[2], Sandeep Kumar Jain[3], T T Krithika[4]

[1]Resident 3rd Year, Department of Cardiology, Fortis Escorts Hospital, Okhla, New Delhi, India, [2]Senior Resident, Department of Medicine, Chhindwara Institute of Medical Sciences, Chhindwara, Madhya Pradesh, India, [3]Assistant Professor, Department of Medicine, Chhindwara Institute of Medical Sciences, Chhindwara, Madhya Pradesh, India, [4]Senior Resident, Department of Community Medicine, Karwar Institute of Medical Sciences, Karwar, Karnataka, India

Abstract

Background: The progression of HIV infection is studied through the haematological abnormalities correlating with CD4 cell counts.

Methods: The number of participated HIV infected patients were (n=120) in this study to evaluate the haematological abnormalities arises during the advancement of the disease. Also, 2–5 ml blood samples were collected to determine the CD4 count haematological parameters. The considered standard values of haematological parameters were followed to study Anemic condition for men Hb<13%, for non-pregnant women Hb<12 gm%), thrombocytopenia (platelets <1.5 lakh/mm^3) leucopenia; white blood cells <4000/mm^3.

Results: The current study deals with n=120 HIV infected patients. A common sign of AIDS disease is anaemia, approximately 46% of patients were affected followed by leukopenia 25% and rest 24% of thrombocytopenia patients with lowered CD4 counts was observed. The lowered value of CD4 count was observed <200 cells/μL in these patients, the incidence of anaemia, leukopenia and thrombocytopenia was 22/46(47.8%), 14/25(56%) and 13/24(54.1%) respectively, while the incidence of anaemia, leukopenia and thrombocytopenia was found in patients with CD4 count >500 cells/μL was least one i.e. 5/46 (10.8%), 1/25(4%) and 2/24(8.3%), respectively. The plate count decreases as the CD4 count (<500 cells/μL) decreases at (p=0.032) level and had a statistically significant relationship with CD4 counts.

Conclusion: HIV infection/AIDS disease progression could be measured by haematological changes and these abnormal changes indicate the disease severity. The anaemic condition being the most common abnormality had a significant correlation with CD4 counts followed by leukopenia and least one by thrombocytopenia, hence advanced stages of disease could be predicted as an anaemic condition approaches to become severe.

Key words: Anemia, CD4 count, Haematological, HIV, Leukopenia, Thrombocytopenia

INTRODUCTION

Human immunodeficiency infection more suitable called AIDS, which is caused by a human deficiency virus (HIV), an RNA virus belongs to the retrovirus family. HIV attacks human immune system1 and ultimately destroy the defence system i.e. both innate and acquired immunity.[1,2] This attacking virus preferentially destroys the CD4 lymphocyte cells and reduces CD4 cells population day by day. It has been calculated that each day approx >109 CD4 cells were destroyed.[3,4] CD4 cell population decline is directly linked to the HIV viral load and measure the disease severity rate.[5] Previously, India becomes the third-largest country where the number of HIV-infected patient cases arises across the world after South Africa and Nigeria. In India, recent reports suggest the around 2.1 million individuals were infected with HIV/AIDS by the end of 2017 with an adult prevalence of 0.2% between the age group of 15-49 years. Haematological parameters were considered to assess diagnosis and measure its progression rate.[6]

Usually, the number of mature blood cells reduces known as cytopenias, identified in HIV positive patients.

Corresponding Author: T T Krithika, Department of Community Medicine, Karwar Institute of Medical Sciences, Karwar, Karnataka, India.

Cytopenias are a common cause of anaemia in HIV patients showed 60-80% haematological abnormalities arise in the later stage of HIV suffered patients.[7,8] Progression of Anemia, various factors are accountable in HIV suffered patients, including vitamin B-12, iron, folic acid, malabsorption insufficiencies, infiltration bone marrow and erythropoietin production rate decreases with HIV infection progress.[9]

HIV associated hematologic expressions seem to be dependent on the level of viral replication, as these abnormalities are severe in AIDS patients with high viraemia and decreased CD4 counts.[10]

Depending on the viral load, several haematological abnormalities arises associated with HIV infection, these abnormalities become severe in AIDS patients with decreased CD4 count and high viraemia. Few reports were studied associated with haematological changes and their correlation with CD4 count. The current study aimed to demonstrate the haematological changes associated with HIV infection and its correlation with CD4 count to check up the disease progression.

MATERIALS AND METHODS

The present prospective study was conducted in the ART centre and the department of general Medicine, GR medical college, Gwalior on 120 HIV positive patients who were newly diagnosed. All the patients have undergone a detailed haematological evaluation. The data obtained was captured in a pre-defined proforma and data analysis was performed. Based on the data analysis following observation were obtained. All the participated patients had undergone a detailed clinical; haematological radiological investigations were done at the time of registration. Also, 2–5 ml quantity of blood samples was withdrawn carefully in a vacutainer tube to calculate the CD4 count and determines the haematological parameters. The minimum prescribed values were described to calculate the different haematological parameters such as Anemia: for men Hb <13%, for non-pregnant women Hb<12 gm%), thrombocytopenia (platelets <1.5 lakh/mm³) leucopenia; white blood cells <4000/mm³.

Statistical Analysis
All the data analysis was performed using IBM SPSS ver. 20 software. Frequency distribution and cross-tabulation were used to prepare the tables. Categorical data were expressed as a percentage. PRISM and Microsoft office was used to prepare the graphs. The Chi-Square test was used to compare the categorical data. The P-value of <0.05 level was considered statistically significant.

RESULTS

Demographic Study
The current study dealt with 120 patients, 53.3% were males and 46.7% were females. Male patients were more involved in comparison to female patients. The age of the patients varied from <20 yrs to >50 yrs. The maximum numbers of patients (46.7%) participated in this study, were the age group of between 31-40 yrs. The mean age of the patients was 40±31.99 years.

Haematological Parameters
In this study, the number of participated patients were (n=120) HIV infected patients, at the initial stages of HIV infection; several haematological abnormalities such as anaemia, leucopenia, and thrombocytopenia were frequently encountered. The most common symptoms are anaemia, approx. 46% of patients were affected, followed by leukopenia 25% and the rest are 24% of thrombocytopenia patients. Table 1 depicts the different mean value of haematological parameters in HIV infected patients. The CD4 marker system is employed to the efficacy of the immune system of HIV patients. The CD4 counts were further categorized into two groups: less than 500 cells/μL and more than or equal to 500 cells/μL. Initially, anaemia, leucopenia and thrombocytopenia were common symptoms of HIV-infected patients having lower CD4 counts. The lowered value of CD4 count was <200 cells/μL observed in these patients, the incidence of anaemia, leukopenia and thrombocytopenia was 22/46 (47.8%), 14/25 (56%) and 13/24 (54.1%), respectively, while the incidence of anaemia, leukopenia and thrombocytopenia was found in patients with CD4 count >500 cells/μL were least one i.e. 5/46(10.8%), 1/25(4%) and 2/24(8.3%), respectively.

In the present study, among 120 patients, male patients had lowered haemoglobin level of <13 gm% (93.7%) and rest 6.3% had a hemoglobin level of ≥13 gm%. Among females, the majority of the patients had haemoglobin level <12 gm% (87.5%) and 12.5% had haemoglobin level ≥12 gm%. From this data, the anaemic condition was graded according to the haemoglobin level. Females

Table 1: Comparing CD4 count with different haematological parameters

Parameters	CD4 count (cells/μL)		P-value
	<500	**≥500**	
Hb (gm%)			
Normal	2 (2.1)	1 (3.8)	0.002
Abnormal	92 (97.9)	25 (96.2)	
Platelet count (lakh/mm³)			
<1.5	27 (28.7)	3 (11.5)	0.032
≥1.5	67 (71.3)	23 (88.5)	

were more prone to shift to severe anaemia than males as summarized in Figure 1.

Table 1 relates the severity of anaemia in case of patients with <500 CD4 counts 92(97.9) than the >500 CD4 count 25(96.2) respectively, which was statistically significant at p=0.002 level. The commonest type of anaemia was normocytic normochromic, which was accounted in 49.2% patients, while microcytic hypochromic anaemia was observed in 17.5% patients and the rest of the 25% of patients had macrocytic anaemia. Out of the 46 patients, 2 patients were undergone for thrombocytopenia, where plate count decreases as the CD4 count (<500 cells/μL) decreases at (p=0.032) level as shown in Table 2.

Rectic count (reticulocyte count) actually, reticulocyte count represents the formation and release of RBC by the bone marrow into the blood. The mean corpuscular volume (MCV) represents the average volume of RBC. Figure 2 showed the maximum MCV percentage of 38.3 in the range of 80-100 fl, it was noted that the infected HIV patients were prone to the anaemic condition as the disease progress. However, the p-value was found statistically significant as shown in Table 1 as<500 cells/μL CD4 count appears in the blood and plate count number increased from 3–23 lakh/mm^3 reflecting normal to an abnormal condition of patients.

In the present study, the highest value of rectic count was observed in 0.5–2% level i.e. 93.3% shows in Table 3 and there were 6.7% patients, who had the lowest value of retic count <0.5% level. None of the patients had retic count >2.

In the present study, majority of the patients had TLC between 4000–11000/cumm (94.2%) and there were 4.2% patients, who had TLC <4000/cumm and only 1.7% patients had TLC >11000/cumm shows in Table 4, as CD4 counts decreased, TLC values decreased.

Leukopenia was observed in 1/25(4%) of HIV positive patients. Leukopenia cases involve, agranulocytes and lymphocytes, although it was monocytopenia reported in HIV infected patients. Also, Neutropenia level was also decreased with decreased CD4 count, an early sign of HIV infection.

DISCUSSION

Haematological abnormalities are considered as the most common reason for creating complication during HIV infections. These abnormalities involved in all the lineages of blood cells.[11] HIV associated haematological abnormalities appear to be dependent on the level of virus load, as these
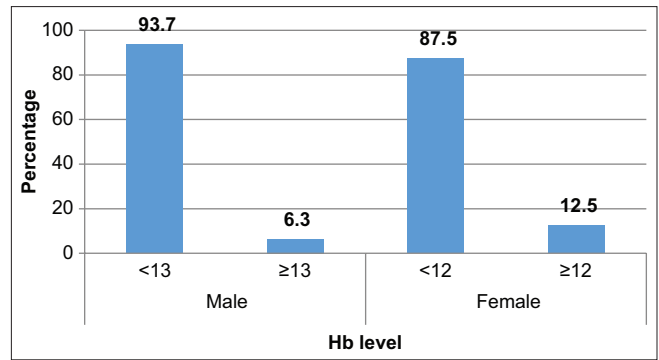

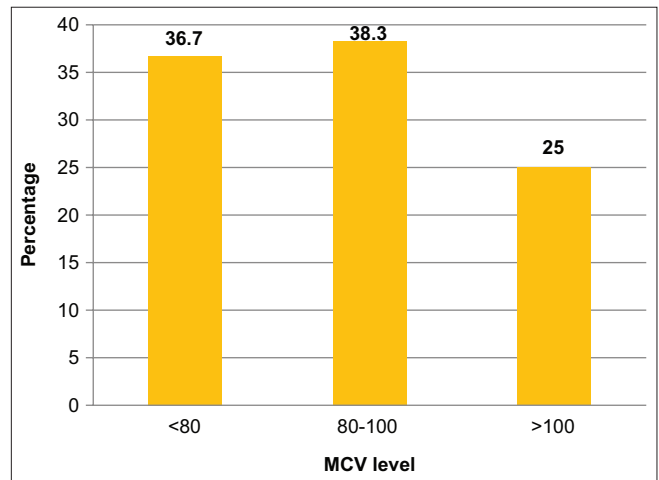**Figure 1: Distribution of patients according to Hemoglobin level**

Figure 2: Distribution of patients according to MCV cut-offs

Table 2: Patients distribution based on Platelet counts (expressed in lakh/cumm)

Platelet count	Frequency	Percentage (%)
<1.5 lakh/mm^3	30	25.0
≥1.5 lakh/mm^3	90	75.0
Total	120	100.0

Table 3: Distribution of patients according to Retic count cut-offs

Retic count	Frequency	Percentage (%)
<0.5%	8	6.7
0.5-2%	112	93.3
>2%	0	0
Total	120	100.0

Table 4: Distribution of patients according to TLC cut offs

TLC	Frequency	Percentage (%)
<4000/cumm	5	4.2
4000-11000/cumm	113	94.2
>11000/cumm	2	1.7
Total	120	100

abnormalities increased as the disease AIDS advances. The actual mechanism highlighting these abnormalities is still not known.[12] Anaemia is the most common cytopenia in HIV-infected patients, the initial occurrence of anaemia is approx. 10-20% of patients and it became more severe in 70–80% of patients as the disease progress. Hence, the incidence of anaemia is strongly significant with disease progression. The current study involved both male (53.3%) and female (46.7%). In this study, the male majority had a haemoglobin level of <13 (93.7%) and 6.3% had a haemoglobin level of ≥13. Among females, the majority of the patients had haemoglobin level <12 (87.5%) and 12.5% had haemoglobin level ≥12. Cleeland *et al.*;[13] Saha *et al.*[14] study found the female distribution in HIV patients with anaemia in 57.33% females. Kusfa *et al.*[15] study, recorded the mean (±SD) values of the haematological parameters (at baseline and 6 months after initiation of ART) where: haemoglobin concentration (10.9±1.95 vs 11.8±1.83 g/dL at 95% CI−1.7713, −0.5030, P-value <0.001). (Ezeonwu *et al.*[16] study found the mean haematological levels of the patients were haemoglobin (Hb) (10.4±1.2 g/dl), neutrophil count (3.031±1.039 cells/mm^3), and platelets count (294±78×109/L). Anaemia was the most common haematological abnormalities arises at the initial stage of the disease, about 77% of patients had haemoglobin below 13 g% and about 6% were having haemoglobin below 6 g%. Ferede and Wondimeneh[17] recorded an overall prevalence of anaemia in 138 (35%) patients. Female HAART naive HIV positive patients had significantly (at p<0.05) higher prevalence of anaemia than males (62% vs 38%). In the present study, the majority of the patients had platelet count ≥1.5 (75%) and there were 25% patients, who had platelet count <1.5. Shruthi *et al.*[18] recorded similar result, where the majority of the patients had platelet count ≥1.5 60 (60%) and there were 40 (40%) patients, who had platelet count <1.5. Shi *et al.*[19] concluded that in HIV infection, early stages may have decreased platelet count due to decreased survival and in late advanced disease due to marrow failure. (Kathuria *et al.*[20] and Carter *et al.*[21] also recorded majority of non-thrombocytopenia (platelet count>1.5 lakhs/mm^3) 38(76%) and 12 (24%) patients had thrombocytopenia (platelet count<1.5 lakhs/mm^3). Leukopenia abnormality arises in patients with the AIDS disease. Neutropenia of fewer than 1000 cells/μL was also reported in approximately 10% of patients with early, asymptomatic HIV infection and more than 50% of individuals with late stages of HIV infection.

CONCLUSIONS

HIV infection/AIDS disease progression could be measured by haematological changes and these abnormal changes indicate the disease severity. The anaemic condition being the most common abnormality had a significant correlation with CD4 counts followed by leukopenia and least one by thrombocytopenia, hence advanced stages of disease diagnosis could be predicted by anaemic condition approaches to become more severe in HIV infected patients.

Therefore, it was important to investigate the reason of causing anaemia and need to find out the appropriate treatment of haematological abnormalities, thereby, reduce the illness and mortality of HIV positive patients. HIV infected patients suffer from haematological abnormalities therefore, abnormalities early diagnosis, exact causing agent finding retrieve the treatment therapy against these abnormalities, which reduces the morbidity and mortality rate of HIV positive patients.

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