

## Association between Red blood cell parameters and immune status in HIV infected males

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### Abstract

**Background and Objectives:** Hematologic changes have been accepted as a powerful predictor of morbidity and mortality in HIV-infected patients. It has been demonstrated that severe anemia is linked with faster rate of HIV disease progression. HIV infection affects hematological indices like MCV (Mean corpuscular volume), MCH (Mean corpuscular haemoglobin) and MCHC (Mean corpuscular hemoglobin concentration) of patients regardless of age, sex and ART. The rationale of this study was to recognize the association between RBC parameters and immune status in male HIV infected patients.

**Methods:** The objective of this study was to consider red blood cell parameters and immune status and to contemplate the relationship between RBC indices and immune status.

**Results:** Among the 48 HIV infected male patients, the CD4 count was significant and positively correlated with the Hemoglobin (HB) and hematocrit (PCV) values. RDW and MCHC were negatively associated but insignificant with CD4 cell count. RBC, MCV and MCH were positively associated but insignificant. CD4 cell count had a wide range with 1376 cells /cmm because of the impact of one patient whose CD4 count was 1435cells/cmm. However, the median was 290 cells /cmm indicating 50% of patients showed deteriorating CD4 cell counts.

**Conclusion:** HIV infection affects the RBC parameters. Anemia is a significant predictor of HIV progression to AIDS. Hemoglobin concentration could be used as a consistent biomarker of the prognosis in HIV-infected patients, and that a therapeutic approach is vital for patients with anemia. There is significant association with reduced CD4 cell count and altered hemoglobin and hematocrit. Evaluation of these parameters certainly improves the condition and endurance of HIV infected patients.

**Keywords:** HIV, CD4 cells, Hemoglobin, Hematocrit, Anemia

### Introduction

Hematologic changes have been accepted as a powerful predictor of morbidity and mortality in HIV (Human immunodeficiency virus) infected patients<sup>(1)</sup>. It has been demonstrated that severe anemia is linked with faster rate of HIV disease progression<sup>(2)</sup>. The reason for HIV associated anemia is acknowledged to be multifactorial. These includes the meandering effects of HIV infection, adverse reactions to therapy, opportunistic infections or malignancies, anorexia or mal-absorption and metabolic disorders related to HIV<sup>(3)</sup>. HIV firmly affects the bone marrow stromal cells which lead to reduced synthesis of red blood cells and other bone marrow elements<sup>(4)</sup>. HIV infection affects hematological indices like MCV (Mean corpuscular volume), MCH (Mean corpuscular haemoglobin) and MCHC (Mean corpuscular hemoglobin concentration) of patients regardless of age, sex and anti-retroviral therapy<sup>(5)</sup>. The Red cell distribution width (RDW) is an automated measurement of the heterogeneity of red blood cell sizes (e.g. anisocytosis) and is usually performed as component of a complete blood cell counts. Implication of Red cell distribution width lies in establishing the differential diagnosis of anemia. Red cell distribution width is also considered as a new marker of inflammatory activity<sup>(6)</sup>.

Chamarajanagar district in Karnataka state is located in the southern part. The population of Chamarajanagar is 10.20 Lakhs with a sex ratio of 989 females for every 1,000 males, and a female literacy rate of 54.32% with an overall literacy rate of 61.12% (Census 2011). The rationale of this study was to recognize the association between RBC parameters and immune status in male HIV infected patients. In view of this, the objective of this study was to consider red blood cell parameters and immune status and to contemplate the relationship between RBC indices and immune status.

### Materials and Methods

The present study was a cross sectional study done on secondary data maintained in the hematology laboratory from March 2015 to October 2015, in Chamarajanagar Institute of Medical Sciences, Chamarajanagar. Consent from the concerned authorities was obtained to gather the secondary data. The privacy of patients was maintained by the hospital by not disclosing their names, as this data belonged to the hospital. Therefore this secondary data did not require the consent of the patients. Subjects for the study were the reports of HIV patients above 21 years of completed age who were not on anti retroviral therapy, registered in the ART centre during the period

mentioned above. According to 2012 ICTC (Integrated Counseling and Testing Centre) data for Chamarajanagar district, the HIV prevalence was male (2.13%) attendees. To detect the sample size “The confidence interval approach” was used. The inflated sample size for male was 34. The level of significance and absolute allowable error both were fixed at 5%. However all the available patients’ reports (i.e. 48), above 21 completed years of age, in the ART centre during the period of the data collection were selected. The P value for age, i.e. 0.057 suggests that the reports of patients have been randomly distributed across the age. Objectives were analyzed using the statistical techniques such as sample median, range, maximum, minimum, Mood median test, Spearman correlation, its test and SPLOM chart using standard statistical tool called R software.

**Results**

Table 1 shows Spearman rho and its p-value to know the association levels. RDW and MCHC were negatively associated but insignificant with CD4 cell

count. RBC, MCV and MCH were positively associated but insignificant. However, hematocrit (PCV) and hemoglobin (HB) were positively associated but significant with CD4 cell count. Thus in this study, the parameters discussed are hematocrit and hemoglobin. However, the rest of the parameters values are available in the tables for the completion of the study. Table 2 provides the descriptive statistics of the parameters. Hematocrit had a median of 35.8% and hemoglobin (HB) had a median of 12.4g%. But HB has wide range of 7.9g% and PCV had a range of 25.2%. CD4 cell count had a wide range with 1376 cells /cmm because of the impact of one patient whose CD4 count was 1435cells/cmm. However, the median was 290cells/cumm indicating 50% of patients showed deteriorating CD4 cell counts. Table 3 shows number of patients less than and more than the respective medians along with the 95% confidence interval. From the Table, 33 patients showed decreasing CD4 cell counts. 33 patients had PCV more than 33%. 18 patients had HB less than 12.4g%.

**Table 1: Spearman Rho association table**

	PCV	RDW	RBC	MCV	MCH	MCHC	HB
RDW	-0.479 0.001						
RBC	0.286 0.049	0.005 0.976					
MCV	0.490 0.000	-0.262 0.072	-0.470 0.001				
MCH	0.354 0.014	-0.236 0.106	-0.404 0.004	0.796 0.000			
MCHC	-0.284 0.050	0.125 0.396	0.208 0.156	- 0.473 0.001	0.132 0.371		
HB	0.812 0.000	-0.410 0.004	0.431 0.002	0.205 0.163	0.412 0.004	0.284 0.050	
CD4	0.469 0.001	-0.261 0.073	0.231 0.114	0.169 0.252	0.210 0.152	-0.022 0.884	0.401 0.005
Cell Contents: Spearman rho P-Value							

**Table 2: Descriptive Statistics**

Variable	Minimum	Median	Maximum	Range
PCV	24.500	35.800	49.700	25.200
RDW	12.700	16.100	25.500	12.800
RBC	2.350	3.945	34.200	31.850
MCV	48.40	90.00	120.00	71.60
MCH	16.800	31.600	41.400	24.600
MCHC	28.900	34.450	39.300	10.400
HB	8.600	12.400	16.500	7.900
CD4	59.0	290.0	1435.0	1376.0

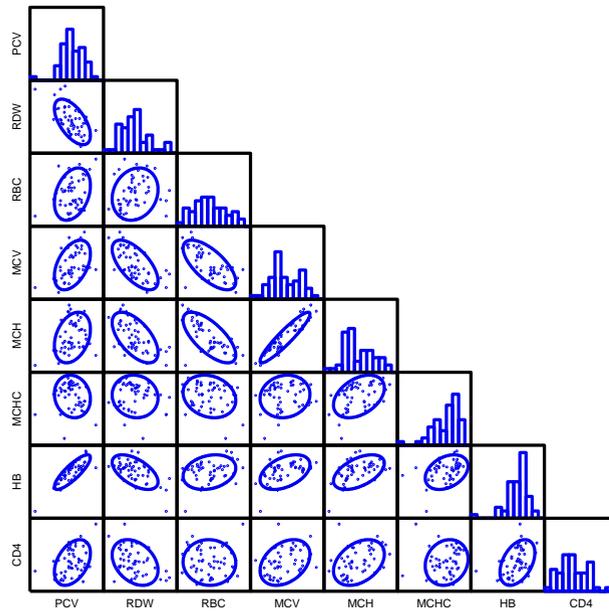
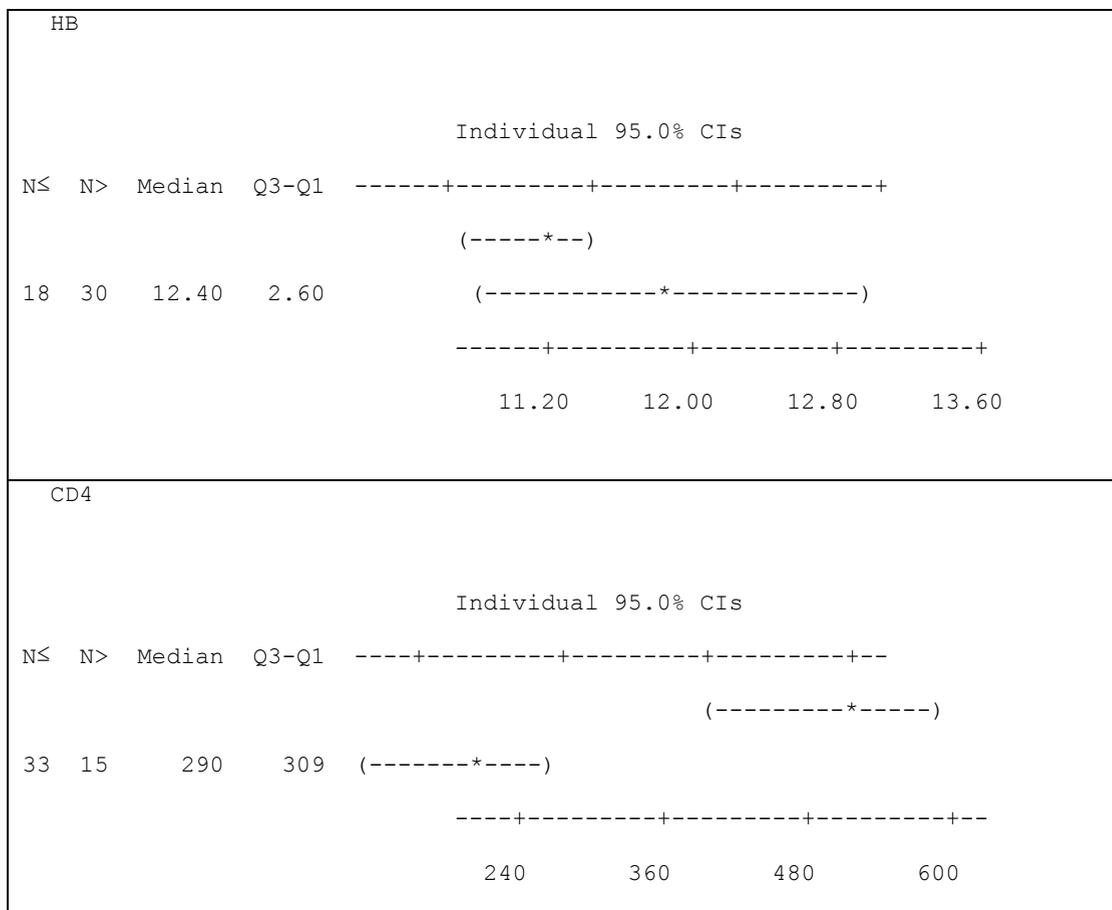


Fig. 1: SPLOM PLOT

Table 3: Frequency table for parameters

PCV				Individual 95.0% CIs			
N≤	N>	Median	Q3-Q1	-----+-----+-----+-----			
				(-----*-----)			
14	34	35.80	5.27	(-----*-----)			
				-----+-----+-----+-----			
				32.0	34.0	36.0	
RDW				Individual 95.0% CIs			
N≤	N>	Median	Q3-Q1	-----+-----+-----+-----			
				(-----*-----)			
25	23	16.10	1.95	(-----*-----)			
				-----+-----+-----+-----			
				15.60	15.90	16.20	
RBC				Individual 95.0% CIs			
N≤	N>	Median	Q3-Q1	--+-----+-----+-----+-----			
				(-----*-----)			

18	30	3.945	0.820	(-----*-----)	
				-----+-----+-----+-----	
		3.30	3.60	3.90	4.20
MCV					
				Individual 95.0% CIs	
N≤	N>	Median	Q3-Q1	-----+-----+-----+-----	
				(-----*-----)	
20	28	90.0	23.1	(-----*-----)	
				-----+-----+-----+-----	
		85.0	90.0	95.0	100.0
MCH					
				Individual 95.0% CIs	
N≤	N>	Median	Q3-Q1	-+-----+-----+-----+-----	
				(-----*-----)	
22	26	31.60	6.45	(-----*-----)	
				+-----+-----+-----+-----	
		28.0	30.0	32.0	34.0
MCHC					
				Individual 95.0% CIs	
N≤	N>	Median	Q3-Q1	-----+-----+-----+-----	
				(-----*-----)	
25	23	34.45	5.15	(-----*-----)	
				-----+-----+-----+-----	
		34.0	35.0	36.0	



**Discussion**

The chief impediments of HIV infection are the changes in hematological parameters which are clinically important.<sup>(6)</sup> The present study observed a significant correlation with CD4 cell count for RBC parameters namely hematocrit and hemoglobin, however it was insignificant for the other parameters. Hemoglobin levels reveal the pace of the disease progression and independently predict the prognosis<sup>(7,8)</sup>. The reduction in hemoglobin levels relay on the falling CD4 counts<sup>(9,10)</sup>. However the present study did not involve patients on antiretroviral therapy. Previous study has showed that soluble factors like HIV proteins and cytokines may hinder the development of hematopoietic cells in the bone marrow<sup>(11)</sup>.

Anemia, neutropenia, and thrombocytopenia, are frequently observed in patients infected with HIV. Therefore total lymphocyte count, white blood cell count, and hematocrit or hemoglobin concentration have been proposed as alternative markers of the disease, particularly for developing countries where financial assets are limited. Hemoglobin concentration was found to be a consistent predictor factor for disease progression<sup>(12)</sup>. In the present study the hemoglobin showed a median of 12.4 g% and range of 7.9g%.

Haemoglobin is both simple and economical to measure. Monitoring haemoglobin levels could be used

to alert clinicians to those patients who call for a usual clinical follow-up or who may necessitate treatment for their anaemia. Earlier study found that treatment of anaemia with erythropoietin was allied with an enhanced prognosis perhaps by allowing higher doses or extended use of drugs such as zidovudine and ganciclovir<sup>(5)</sup>. Hemoglobin value revealed to play a vital role in the fundamental management of HIV disease in West Africa<sup>(13)</sup>.

In the present study Hematocrit had a median of 35.8% with a range of 25.2%. Earlier studies showed HIV patients had significantly low mean and frequency of HB (10.20±2.05) g% and HCT (32.19±6.30)%; 119(79.9)%<sup>(14)</sup>. Hematocrit values were similar to previous studies with most productive group having a mean of 0.33%<sup>(15)</sup>. Previous researchers observed that the yearly incidence of developing anemia increases with the disease development affecting 3% of all patients with asymptomatic HIV infection. The low RBC parameters could be as a consequence of decreased red blood cells production or ineffective erythropoiesis. Anemia has been shown to be a statistically considerable interpreter of evolution to acquired immunodeficiency syndrome (AIDS) and is independently associated with increased risk of death in patients with HIV.<sup>(14)</sup>

## Conclusion

HIV infection affects the RBC parameters. Anemia is a significant predictor of HIV progression to AIDS. Hemoglobin concentration can be used as a consistent biomarker of the prognosis in HIV infected patients, and that a therapeutic approach is vital for patients with anemia. There is a significant association with reduced CD4 cell count and altered hemoglobin and hematocrit. Evaluation of these parameters certainly improves the condition and endurance of HIV infected patients.

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