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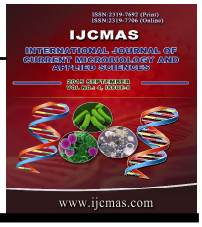

Original Research Article

Correlation between Total Leukocyte Count, Absolute lymphocyte count, Hemoglobin, Erythrocyte sedimentation rate and CD4 Count in HIV/AIDS Patients

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Keywords

TLC, ALC, HB, ESR, CD4 count, HIV/AIDS

A B S T R A C T

In resource-limited settings, due to the high cost of CD4 cell count testing, physicians must decide about opportunistic infection prophylaxis without a laboratory evaluation of HIV stage and level of immune suppression. Total leukocyte count (TLC), absolute lymphocyte count (ALC), hemoglobin (Hb) and erythrocyte sedimentation rate (ESR) can be recommended as simple & inexpensive surrogates. The aim of this study was to assess the correlation of these parameters as substitutes for CD4 count, as an inexpensive laboratory parameter, for the initiation of opportunistic infection prophylaxis, appropriate for resource-limited settings. From August 2012 to August 2013, 25 HIV-positive patients attending the link ART Centre, SRG hospital, Jhalawar, Rajasthan, India, were selected to participate in a prospective observational cohort study. All statistical analyses were performed using SPSS software. P value <0.05 was considered as statistically significant for all the tests. Good correlation was noted between TLC, ALC, ESR and CD4 counts (p value < 0.05) while a poor correlation was noted between Hb and CD4 count (p value > 0.05). TLC, ALC and ESR could serve as a low-cost tool for determining when to initiate prophylaxis in resource limited settings.

Introduction

In resource-limited settings, chemo-prophylaxis for opportunistic infections, may improve quality of life, decrease morbidity, and lengthen survival of HIV-positive patients (Dayton and Merson, 2000; Kaplan *et al.*, 1996). The enumeration of CD4 count, an essential tool for the laboratory monitoring of HIV- infected patients, both for the progression of disease and for the assessment of the outcome of the anti-retroviral treatment (Pattanapanyasat and Thakar, 2005).

In resource-limited countries, routine use of CD4 count and plasma viral load regarding the treatment of HIV infection has not been yet possible. Methods of CD4 count, require expensive laboratory equipments and expertise for the traditional methods such as immuno-phenotyping (flow cytometry) or labeling (monoclonal antibodies). Plasma viral load testing has also been extremely difficult to manage (Kumarasamy *et al.*, 2002a).

A CD4 count of < 200 cells/mm3, associated with increased risk of developing *Pneumocystis carinii* pneumonia (PCP) in HIV-positive patients (Phair *et al.*, 1990), recommended reference point regarding initiation of cotrimoxazole prophylaxis [U.S. Public Health Service (USPHS) and Infectious Disease Society of America (IDSA)., 2010].

CD4 count and viral load tests, rarely available in resource poor settings, due to inadequate infrastructure, high cost and poor supply of trained personnel to administer tests (Colebunders et al, 2006) WHO has recommended the use of absolute lymphocyte count (ALC) in addition to WHO clinical staging criteria in an alternative algorithm (WHO, 2003).

ALC is easily obtained from the routine complete blood count (CBC) with differential through multiplication of lymphocyte percentage by TLC. So total leukoocyte count (TLC), absolute lymphocyte count (ALC), hemoglobin (Hb) and erythrocyte sedimentation rate (ESR) can be recommended as simple & inexpensive surrogates. We have therefore undertaken this study to assess the correlation of these parameters as substitutes for CD4 count, as an inexpensive laboratory parameter, for the initiation of opportunistic infection prophylaxis, appropriate for high prevalence of co-infection in resource-limited settings.

Material and Methods

Study design and setting

A prospective observational cohort study involving 25 HIV-positive patients, attending our Link ART Centre, SRG hospital, Jhalawar, Rajasthan, India, from August 2012 to August 2013 were selected. The duration of study period was 1 year, in this period the patients were investigated at the time of entry, after 6 months and 1 year to link ART when the CD4 count of patient was done.

Selection and description of participants

After taking an informed consent (for HIV testing), patient attending our ICTC (or any other Government designated ICTCs), underwent pre-test counseling, followed by HIV testing as per the strategy III of the NACO guidelines for HIV testing (National AIDS Control Organization. HIV testing manual, 2001). After post-test counseling, those found HIV positive, referred to the Link ART Centre, for pre-ART counseling. After clinical evaluation, informed consent was taken from these patients and enrolled into the study if they satisfied the inclusion criteria. As per the WHO guidelines, patients found HIV sero-positive were started on anti-retroviral therapy (WHO, 2006). This study was approved by the ethics Committee of our institution.

Inclusion criteria

Individuals > 18 years of age, HIV-positive and not on prior anti-retroviral therapy (ART) were included.

Exclusion criteria

HIV sero-negative individuals, < 18 years of age and on prior ART were excluded.

Statistical analysis

All statistical analyses were performed using SPSS software (version 16.0, SPSS, Chicago, USA).

Results and Discussion

The correlations between TLC, ALC and ESR with CD4 cell count were highly

significant but correlation of Hb with CD4 did not fall in significant range.

Results of this study demonstrate that in the majority of HIV/AIDS patients, there is a positive correlation between CD4 count and TLC, ALC and ESR but there is no significant relationship between CD4 and Hemoglobin, so in the remote and deprived areas of Jhalawar, Rajasthan, with the scarcity of laboratory technologies (*i.e.* CD4 counting is not available); ALC, TLC and ESR are a useful and acceptable surrogate marker for CD4 count.

The present study shows that in ALC is a suitable predictor of CD4 count. This finding is consistent with other studies. (Kumarasamy *et al.*, 2002b; Post *et al.*, 1996; van der Ryst *et al.*, 1998; Spacek *et al.*, Badri and Wood, 2003). In this study, we found that 33.33% of patients had ALC < 1520 cells/μL compared to CD4 < 200 cells/μL that is slight higher 38% indicates a correlation of ALC at a range of 1520 cells/μL with a CD4 count of 200 cells/μL as seen in the study done by Kakar *et al.* (2011). Obviously, the findings of such studies are conflicting in different countries, it can be due to different racial, ethnic, socioeconomic and epidemiological factors in HIV/AIDS patients also can be due to different male to female ratio of patients.

Ndakotsu *et al.* (2008) studied HIV-infected adults and controls in Nigeria emphasizes that ESR may be useful in monitoring HIV/AIDS disease regarding opportunistic infection.

This study shows a poor correlation between CD4 and Hb, the finding being far from Spacek *et al.* (2003) and Lau *et al.* (2003). This disagreement may be due to malnourishment and various socioeconomic factors in our patients and also due to differences in various countries as mentioned before. We believe that the results of this study should be confirmed by further investigations.

The present study didn't apply this new method to HIV patients receiving therapy; however, we feel that good results are obtained if our method were adjusted to do so. After having initiated the ART, we understand that blood cells reveal multifarious change. When we can more clearly understand how these changes will affect our model, we have to apply this new method to post-treatment HIV patients using individual CD4 counts.

Finally, this study reveals that ALC is a suitable and useful surrogate marker for CD4 count, but in the case of ALC> 1520 cells/μL, it is necessary to test CD4 counting. Hemoglobin is of limited value in predicting CD4 counts and should not be substituted for CD4 counts.

In conclusion, the present findings suggest that TLC, ALC and ESR could have clinical utility in determining when HIV-infected patients should initiate HAART although ALC is comparatively a better marker in resource-poor settings. However, for resource-limited settings more studies are required with larger study groups to ascertain the usefulness of ALC/TLC/ESR as a surrogate for CD4 counts both before and after HAART initiation as more convenient and less expensive method, alternatives to CD4 cell assays and for reducing the financial burden of determining HIV disease stage and monitoring therapeutic outcomes.

Table.1 Showing mean, standard error of mean, median, standard deviation and range of investigation at the time of entry, after 6 months and 1 year

Parameter	Investigation at the time of entry (1st)					After 6 months of entry (2nd)					After 1 year of entry				
	CD4	HB	TLC	ALC	ESR	CD4	HB	TLC	ALC	ESR	CD4	HB	TLC	ALC	ESR
Mean	221.48	10.71	6208.4	1488.16	33.08	327.84	11.49	6928	2002	22.8	396.04	11.54	7024	2186.84	13.33
Std. Error of Mean	33.05491	0.48	404.5894	123.11	5.92	38.55652	0.28	418.271	146.42	3.44	35.76784	0.25	269.0279	140.92	1.92
Median	172	11.3	6200	1395	20	243	11.6	6200	1872	20	370	11.6	7500	2262	10.5
Std. Deviation	165.2745	2.38	2022.947	615.55	29.59	192.7826	1.41	2091.355	732.11	17.2	178.8392	1.23	1345.139	704.62	9.42
Range	595	9.7	9870	2460	115	736	6.2	9000	3034	76	753	4.5	6000	3146	45

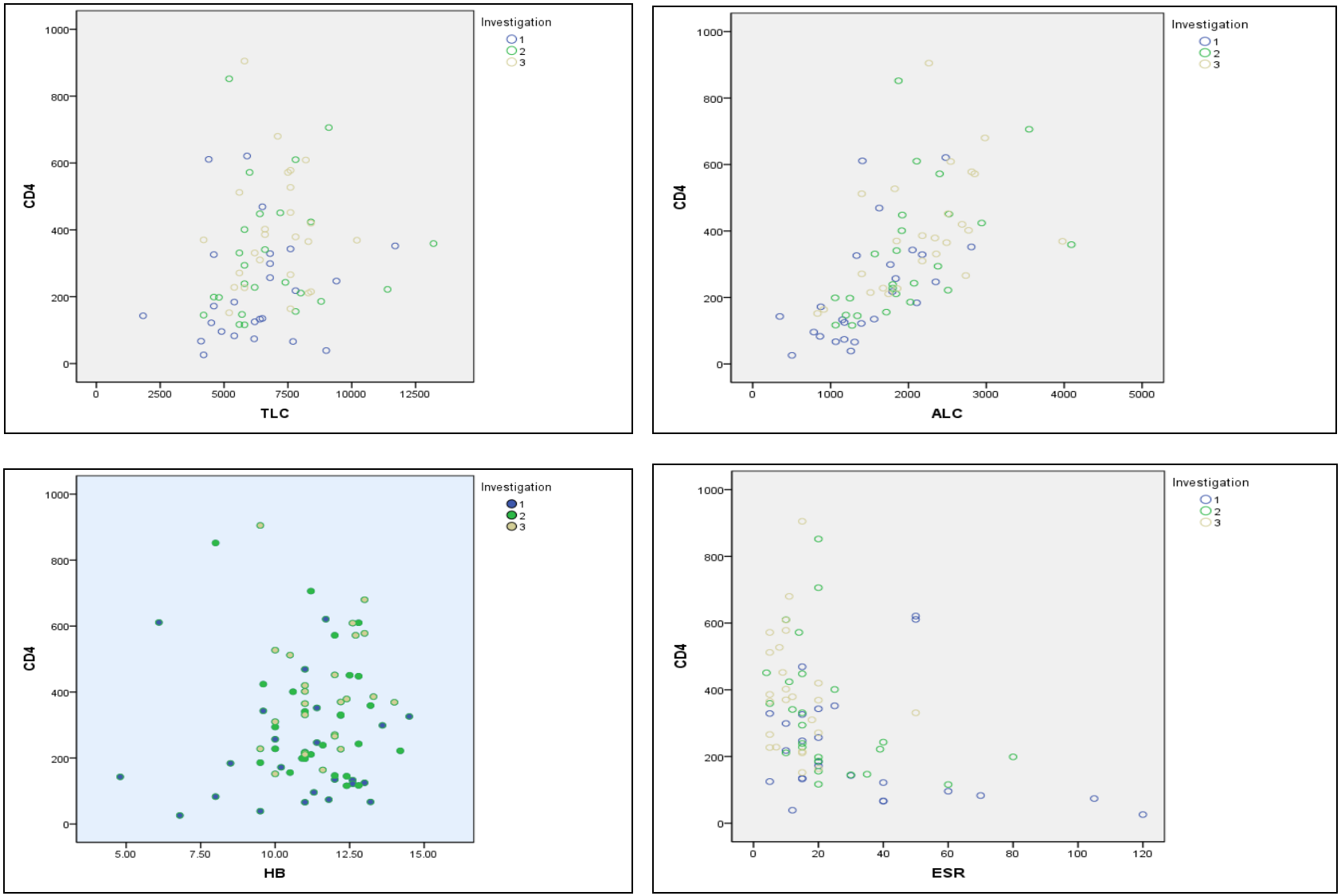
Table.2 Correlations between Hb, TLC, ALC and ESR with CD4 cell count

Parameter	r	P-Value
Correlation CD4*HB	0.09	0.44
Correlation CD4*TLC	0.27	0.01
Correlation CD4*ALC	0.73	0.001
Correlation CD4*ESR	0.42	0.007

Table.3 Showing frequency of CD4 and ALC count

Parameter	Frequency	Percent
CD4<200	24	32.00
CD4>200	51	68.00
ALC<1520	25	33.33
ALC>1520	50	66.67

Figure.1 Scatter diagram showing the distribution of the CD4+ T lymphocytes plotted against the total leukocyte counts (TLC), Absolute lymphocyte count (ALC), Haemoglobin (Hb) levels and Erythrocyte sedimentation rates (ESR) of the study participants



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