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A study on correlation between blood parameters and CD4 count in people living with HIV/AIDS

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Abstract
There are two types of HIV that cause AIDS: HIV-1 and HIV-2. Very little is known about HIV-2. Studies have shown striking similarities but also important differences between HIV-1 and HIV-2. They have the same modes of transmission and are associated with the same opportunistic infections, but HIV-2 appears to progress at a slower rate. Majority of HIV-2 cases are found in western Africa. Various sub types of HIV-1 have been found in specific geographic areas and in specific high risk groups. Evaluation of haematological profile in HIV patients was done with Hb%, RBC, TC, DC, Platelet count, ESR, Bone marrow if needed and biochemical tests.
These haematological abnormalities were correlated with various stages of HIV (WHO stages).
The results were analyzed by calculating percentage, mean, standard deviation, chi-square test and fisher exact. In our study, among the patients with CD4 count <200 cells/microlitre; 65% had anemia, 55% had raised ESR, 33% had leukopenia, 30% had neutropenia, 28% had lymphocytopenia, 45% had mono cytopenia and 50% had thrombocytopenia. Among the patients with CD4 count ≥200 cells/microlitre; 66% had anemia, 66% had raised ESR, 8% had leukopenia, 8% had neutropenia, 8% had lymphocytopenia, 50% had mono cytopenia and 41% had thrombocytopenia.

Keywords: blood parameters, CD4 count, HIV/AIDS

Introduction
At the beginning of 1986, despite over 20,000 reported AIDS cases worldwide[32], India had no reported cases of HIV or AIDS. India's first case of HIV was diagnosed among sex workers in Chennai, Tamil Nadu. In 1987, a National AIDS Control Programme was launched to coordinate national responses [1].

In 1992, the Government of India set up NACO (the National AIDS Control Organization), to oversee the formulation of policies, prevention work and control programs relating to HIV and AIDS. In the same year, the government launched a Strategic Plan for HIV prevention. By this stage, cases of HIV infection had been reported in every state of the country.

In 2001, the government adopted the National AIDS prevention and control policy [2].

HIV disease is a continuum of progressive damage to the immune system from the time of infection to the manifestation of severe immunologic damage by opportunistic infections, neoplasms, wasting or low CD4 lymphocyte count that defines AIDS. Nearly all infected persons have a CD4 lymphocyte count that define lymphocyte count below the mean for seronegative persons and show a progressive loss of these cells over time. The median incubation period from HIV infection until development of AIDS is estimated at approximately ten years for young adults.

The human immunodeficiency virus (HIV) is a retrovirus belonging to the family of lenti-viruses. Retrovirus have the ability to use their RNA and host DNA to make viral DNA and are known for their long incubation periods. Like other retroviruses, HIV 8 infects the body, has a long incubation period (clinical latency), and ultimately causes the signs and symptoms of disease, in this case AIDS. HIV cause severe damage to the immune system and eventually destroys it. HIV accomplishes this by utilizing the DNA of CD4+ cells to replicate itself. In that process, the virus eventually destroys the CD4+ cells [3, 4, 5].

There are two types of HIV that cause AIDS: HIV-1 and HIV-2. Very little is known about HIV-2. Studies have shown striking similarities but also important differences between HIV-1 and HIV-2. They have the same modes of transmission and are associated with the same opportunistic infections, but HIV-2 appears to progress at a slower rate.

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Majority of HIV-2 cases are found in western Africa. Various sub types of HIV-1 have been found in specific geographic areas and in specific high risk groups. A person can be co-infected with different sub types. These are A, B, C, D, F, H, J and K. Africa has most sub types, although sub types B is less prevalent. Subtype C is largely predominant in India. There are no known sub types of HIV-2 [6].

Methodology

It was a prospective study in which HIV patients were diagnosed by clinical profile, biochemical tests like ELISA, CD4 counts. Evaluation of haematological profile in HIV patients was done with Hb%, RBC, TC, DC, Platelet count, ESR, Bone marrow if needed and biochemical tests.

These haematological abnormalities were correlated with various stages of HIV (WHO stages).

The results were analyzed by calculating percentage, mean, standard deviation, chi-square test and fisher exact.

Proportion were compared with chi-square test of significance and p-value of <0.05 for considered statistically significant.

Design of study
Prospective study.

Inclusion criteria
- All patients with HIV infection.
- HIV infection proven by ELISA.

Exclusion criteria
- Chronic infection like tuberculosis.
- Alcoholics.
- Worm infestations.
- Chronic kidney disease.
- Drug intake (phenytoin).
- Patient on anti-retroviral therapy

Results

Table 1: Correlation between Hb and CD4 Count in Male

Hb(g/dl)	CD4 < 200	CD4 ≥ 200	Total	Fisher exact test
< 13	45	7	52	P=0.165
>13	2	3	5	

Table 2: Correlation between Hb and CD4 count in female

Hb(g/dl)	CD4 < 200	CD4 ≥ 200	Total	Fisher exact test
< 12	25	1	26	
>12	16	1	17	P=0.759
Total	41	2	43	

Table 3: Correlation between Total count and CD4 count

Total Count(cells/mm³)	CD4 < 200	CD4 ≥ 200	Total	Fisher exact test
< 4500	29	1	30	P =0.08
>4500	59	11	70	

29 of the patients with CD4 count <200/microlitre and 1 of patients with CD4 count ≥ 200/microlitre had leucopenia. Correlation was found to be not significant (*p*>.05)

Table 4: CD count & Lymphocytopenia

CD4 count	No. of cases
<200	25
200-499	1
>500	0

All patients who had lymphocytopenia were having CD4 count <200/microlitre. 1 patient had lymphocytopenia in CD4 count >200 group. This establishes the relationship between lymphocytopenia and low CD4 counts.

Table 5: Correlation between Neutrophil and CD4 count

Neutrophils (%)	CD4 < 200	CD4 ≥ 200	Total	Fisher exact test
< 50%	27	1	28	P =0.10, NS
>50%	61	11	72	

27 of patients with CD4 count <200/microlitre and 1 patient with CD4 count ≥200/microlitre had neutropenia. Correlation found to be not significant (p=0.10). Neutrophil count ranged from 38 to 91.

Table 6: Correlation between Lymphocyte and CD4 count

Lymphocyte (%)	CD4 < 200	CD4 ≥ 200	Total	Fisher exact test
< 22%	25	1	26	P =0.14, NS
>22%	63	11	74	

25 patient with CD4 count <200/microliter and 1 patient with CD4 count ≥ 200/microlitre had lymphocytopenia, correlation found to be not significant (p=0.14).

Table 7: Correlation between Monocyte and CD4 count

Monocyte (%)	CD4 < 200	CD4 ≥ 200	Total	Fisher exact test
< 4%	40	6	46	P =0.617
>4%	48	6	54	

40 patient with CD4 count <200/microlitre and 6 patient with CD4 count ≥200/microliter had mono-cytopenia, correlation found to be not-significant (p=0.617).

Table 8: Correlation between Platelets and CD4 count

Platelets (lakh/mm³)	CD4 < 200	CD4 ≥ 200	Total	P value
<1.5	44	5	49	P =0.588
>1.5	44	7	51	

44 of patients with CD4 count <200/microlitre and 5 patient with CD4 count ≥200/microlitre had thrombocytopenia. Correlation between platelets and CD4 count found to be not significant (*p*>.05).

Table 9: Correlation between ESR and CD4 count in Male

ESR (mm/hr)	CD4 < 200	CD4 ≥ 200	Total	Fisher exact test
>17	35	8	43	P =0.049
<17	12	2	14	

Table 10: Correlation between ESR and CD4 count in Female

ESR (mm/hr)	CD4 < 200	CD4 ≥ 200	Total	Fisher exact test
>25	13	0	13	P=0.76, NS
<25	28	2	30	
Total	41	2	43	

ESR was raised in 55.6% of patients with CD4 count <200/microlitre and 66% in those with CD4 count ≥200/microlitre. Correlation between ESR and CD4 count

was found to be not significant (p=0.075).

Discussion

The analysis of the association between WHO staging of AIDS and thrombocytopenia, neutropenia, Lymphocytopenia leucopenia were not statistically significant. In contrast the correlation between anemia and WHO staging was statistically significant. The occurrence of anemia was 83% (25 of 30) in stage II, 76.4% (39 of 51) in stage III and 100% (10 of 10) in stage IV. As such occurrence of anemia was higher in all stages, slightly higher in stage IV.

Sulliram *et al*. in the multistate Adult and adolescent spectrum of HIV disease surveillance project reported that the incidence of anemia increased with clinical stages of disease in HIV infection. They found anemia in 3%, 12% and 27% among those with HIV infection alone, immunological AIDS (CD4<200/ml or CD4% <14%) and clinical AIDS respectively [7, 8].

In our study, among the patients with CD4 count <200 cells/microlitre; 65% had anemia, 55% had raised ESR, 33% had leukopenia, 30% had neutropenia, 28% had lymphocytopenia, 45% had monocytopenia and 50% had thrombocytopenia. Among the patients with CD4 count ≥200 cells/microlitre; 66% had anemia, 66% had raised ESR, 8% had leukopenia, 8% had neutropenia, 8% had lymphocytopenia, 50% had monocytopenia and 41% had thrombocytopenia.

Therefore, the number of cases with anaemia, leucopenia, neutropenia, and thrombocytopenia were found to be higher in those patients with CD4 count < 200 compared to those with CD4 count ≥200. This indicates a higher occurrence of cytopenia with the progression of disease117. Though ESR was increased in with CD4 count <200, and those with CD4 > 200 as it can be increased with other chronic infection and illnesses, it cannot be of much value.

But, the study of correlation between haemoglobin, ESR, total count, differential count, platelets with CD4 count<200/microlitre and ≥200/microlitre was found to be statistically not significant ($p>.05$).

As per study conducted by Suresh venkata Satya *et al*., on 470 HIV patients in Varnasi, North India; 74.6% had anemia, 22.7% had neutropenia and 4.8% had thrombocytopenia. A negative association was found between CD4 count and severity of anemia and neutropenia. But no association was found between CD4 count and thrombocytopenia [9].

Another study done by Gil Conha De Santis *et al*. on 701 HIV patients, an association was found between CD4 count and haemoglobin level, neutrophil count and platelet count [150].

Since in our study, number of patients was only 100, included newly diagnosed HIV patients and excluded patients on ART, alcoholics and those with chronic illnesses; we had a different inference than the above conducted studies, which was conducted on a larger number of patients and included patients on ART, and their values during progression of disease.

Conclusion

The analysis of correlation between WHO staging and hematologic abnormalities revealed statistically not significant

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