

The Role of CD4 Count Pattern in HIV Seropositive Patients in Western Part of India

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ABSTRACT

Introduction: Human Immunodeficiency Virus (HIV) infection/acquired immunodeficiency syndrome (AIDS) is the most dreadful disease & a major global health issue affecting mankind. CD4 cell count is one of most important investigations for evaluation of HIV infected patient. Our aim was to assess the CD4 count pattern in seropositive patients.

Material & Methods: A study was conducted on 300 seropositive patients attending ICTC in Department of Microbiology at the tertiary care hospital, fulfilling inclusion and exclusion criteria, all above the age of 15 years, were studied for a period of 20 months. In this study the CD4 counts estimated at the time of baseline (Pre ART), after 6 months and 12 months of (Post ART).

Results: Mean of CD4 count on baseline (Pre ART) was 318.56 ± 230.01 . It improved to the 426.16 ± 239.57 cells/mm³ after 6th months and 524.40 ± 246.84 cells/mm³ after 12th months of ART. Mean CD4 counts in males was 298.56 ± 220.92 and in females was 346.60 ± 240.38 at baseline (Pre ART). Females showed significant improvement than males. Post ART after 6 months there were increase in number of patients from 89 to 149 (55.39%) in >350 CD4 cells range, this is further increase to 205 (76.21%) patients after 12 months. Number of patients with an increasing trend of CD4 counts were seen in 224 (83.27%) patients at 6 months and 241 (89.59%) patients at 12th months, whereas 45 (16.73%) patients had a decreased trend in CD4 counts at post 6th months and 27 (10.04%) patients at 12th months of ART.

Conclusion: The CD4 count is the hallmark surrogate marker for assessing prognosis in HIV infected patients. The programme needs to ensure that maximum number of patients are tested for HIV and linked to the ART centres.

Keywords: Antiretroviral therapy, CD4 count, HIV, HIV prognosis

INTRODUCTION

Human Immunodeficiency Virus (HIV) infection/acquired immunodeficiency syndrome (AIDS) is the most dreadful disease & a major global health issue affecting mankind.¹ HIV was first identified in The USA in 1983 in homosexual & the 1st case of AIDS was found in San Francisco and New York. The first case of

HIV infection of India was reported in a sex worker in Chennai in 1986². There were 37.7 million people living with HIV in 2020, including 10.2 million who were not on HIV treatment. National adult (15–49 years) HIV prevalence was estimated at 0.22% in 2020; 0.23% among males, and 0.20% among females. States of Mizoram,

Nagaland and Manipur had adult prevalence of 1% or higher.³

CD4 count measures the degree of immunosuppression in HIV. There is an inverse relationship between CD4 count and degree of immunosuppression⁴. CD4+T cells after being activated and differentiated into distinct effector subtypes play a major role in mediating immune response through the secretion of specific cytokines.⁵ CD4 cell count is one of most important investigations for evaluation of HIV infected patient. It helps evaluate stage of disease, initiation of anti-retroviral therapy prophylaxis for opportunistic infections, treatment failure. Reference range for normal absolute CD4 count varies with race, ethnicity and gender. The normal absolute count of CD4 T cells in healthy, HIV seronegative adults varies from 330 to 1600 cells/ μ L.⁶

National AIDS Control Programme has adopted attainment of 90-90-90 by 2020 as key targets towards achieving of 'End of AIDS' by 2030. The current recommendation for CD4 is to TREAT ALL, regardless of the clinical stage or CD4 count.³

Aim: To assess the CD4 count pattern in seropositive HIV patients.

Objective: Patients were confirmed for HIV-1 seropositivity as per NACO guidelines.

MATERIAL AND METHODS

Research Setting: All 300 HIV-infected patients visited Integrated Counseling and testing centre (ICTC) at R.N.T. Medical College and ART clinic at M.B. Government Hospital, Udaipur were screened for eligibility and enrolled for this study.

Inclusion Criteria: HIV seropositive confirmed cases as per NACO guideline, but not yet taking ART were included in this study.

Exclusion Criteria: HIV seropositive but on ART treatment patients, below 15 years of age and Pregnant female were excluded.

Permission and Ethical Consideration:

Permission for this study was obtained from the Departmental Research Committee (DRC), Review Board of College and Institutional Ethics Committee (IES).

Methodology:

A Prospective hospital-based study was conducted on 300 HIV-seropositive ART patients of ≥ 15 years of age attending the ICTC, Department of Microbiology at a tertiary care hospital in Western India from November 2020 to June 2022. Blood samples were collected after proper counselling and after obtaining written informed consent from each patient. Then 3 to 4 ml of blood was withdrawn aseptically from each client and testing for anti HIV antibodies was done as per Strategy III of NACO Guidelines. The client was reported seropositive if all the three HIV tests (E/ R/ S) were reactive.

HIV seropositive individuals were referred to the adult ART centre. After following clinical evaluation, the client was referred to the Dept. of Microbiology for CD4 count estimation. CD4 count was estimated when the client first reported to the ART centre (baseline), and thereafter every 6 months. In our study, we considered for analysis, the CD4 counts estimated at baseline (Pre ART) and after 6, 12th months of (Post ART). CD4 count estimation was done on the CYFLOW Count machine as per standard protocol.

STATISTICAL ANALYSIS

Mean and standard deviation were used to present quantitative variables, while proportions were used to present nominal and categorical variables. Quantitative variables were analysed using the independent 't'-test and other parametric tests to determine the difference between two sample means, while nominal/categorical variables were analysed using the chi square test and Fischer exact test to determine the difference between two sample proportions. P values below 0.05 were considered significant. Software called

MedCalc 16.4 was employed to perform the statistical analysis.

RESULTS

This study was conducted on 300 HIV serologically confirmed cases from ICTC,

western India. Out of 300 cases,31 patients were lost to follow up (LFU) during study, so after 12months remaining 269 patients were followed-up; 157were male ,112 were female. our results findings were as follows

Table 1: Mean plasma CD4 count at various time interval and Difference among them (n=269)

	CD4 Counts	Total
Pre ART	Mean on Baseline ± SD	318.56±230.01
	Mean after 6 months ± SD	426.16±239.57
Post ART	Mean after 1 year ± SD	524.40±246.84
	Mean Difference after 6 months	107.60±179.55
	Mean Difference after 1 year	205.84±200.28

Table 2: Mean plasma CD4 count at various time interval and Gender wise Distribution (n=269)

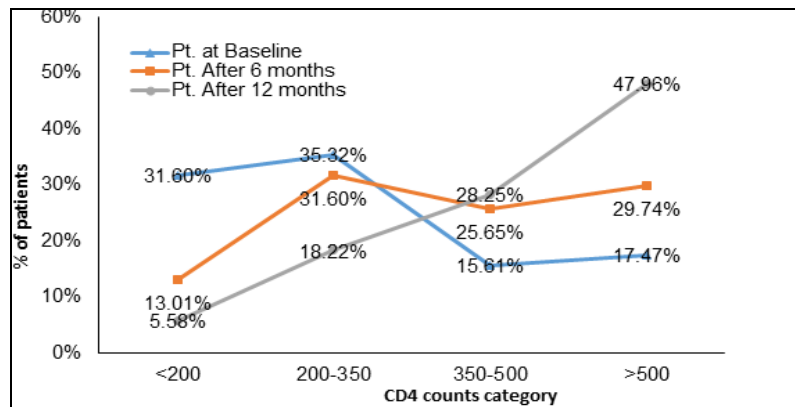
	CD4 Counts	Male (n=157)	Female (n=112)	P value
Pre ART	Mean at Baseline ± SD	298.56±220.92	346.60±240.38	0.09 (NS)
	Mean after 6 months ± SD	387.63±195.29	480.18±282.71	0.003 (HS)
Post ART	Mean after 1 year ± SD	507.59±242.59	547.96±251.87	0.19 (NS)
	Mean Diff. after 6 months	89.07±162.43	133.58±198.98	0.05 (S)
	Mean Diff. after 1 year	209.03±200.54	201.37±200.73	0.76 (NS)

Using Unpaired Student's 't' test in Table 2

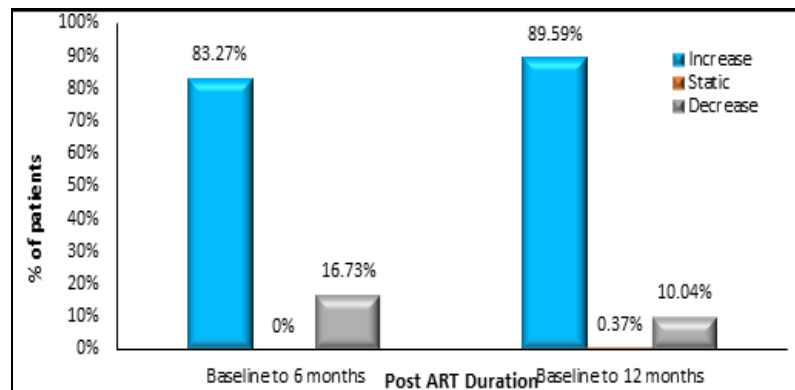
Table 3: CD4 count pattern of Patients at Baseline versus after 6 month and 12months of treatment on ART (n=269)

CD4 count	Pre ART		Post ART			
	Pt. at Baseline		Pt. After 6 months		Pt. After 12 months	
	No.	%	No.	%	No.	%
<200	85	31.60%	35	13.01%	15	5.58%
200-350	95	35.32%	85	31.60%	49	18.22%
351-500	42	15.61%	69	25.65%	76	28.25%
>500	47	17.47%	80	29.74%	129	47.96%

Chi square – 123.35; DF (degree of freedom)– 6; p<0.0001



Graph 1 of Table 3: CD4 count pattern of Patients at Baseline versus after 6 month and 12months of treatment on ART (n=269)



Graph 2: Effect of CD4 cells on Post ART at 6month and 12months (n=269)

DISCUSSION

Table no.1 showed Mean plasma CD4 counts at various interval on Pre ART and Post ART. The mean CD4+ count in ART naive patients was 318.56 ± 230.01 cells/mm³, which is similar to Haokip P et al⁷ (333.9 ± 296.9) at baseline level, it was higher to our study. our patient's CD4 counts mean improved to the mean value of 426.16 ± 239.57 cells/mm³ after six months and 524.40 ± 246.84 cells/mm³ after twelve months. Mugo et al⁸ reported almost similar mean 410.13 at 6months, 439.47 cells/mm³ at 12months. It may be due to difference in immune status and CD4 cell count among healthy HIV seronegative adults of different parts of India. The mean difference of the CD4+ count increased in patients from 107.60 ± 179.55 to 205.84 ± 200.28 during twelve months. It showed a picture that all of them are being benefited from the ART. This indicating good immunological response to ART.

Table 2 depicts that mean CD4 counts in males was 298.56 ± 220.92 and in females was 346.60 ± 240.38 , which was statistically non- significant by Unpaired student t test (p value=0.09) at the time of baseline (Pre ART). This finding is supported by Panda J et al⁹. Post ART males counts were increased from 387.63 ± 195.29 after six months to 507.59 ± 242.59 after twelve months. In females it increased from 480.18 ± 282.71 at six months to 547.96 ± 251.87 at twelve months. In our study Post ART after 6 months, mean rise in CD4 counts was statistically significant using the unpaired t test ($P < 0.05$). Females responded significantly more to males after 6 months of Post ART with mean rise in CD4 count of 133.58 ± 198.98 as compared to males 89.07 ± 162.43 . But post ART after 12 months the increase in CD4 count was almost similar. Females responded significantly more to males. The gender variation of the CD4 cell count has been linked to hormonal differences such as estradiol. A study done by Addisu A et al¹⁰ described that better immunological response in female could reflect the

feminization of the HIV epidemic, better health seeking behaviour of women and possibly the linkage of treatment sites with the antenatal clinics and the prevention-of-mother-to-child HIV programs resulting in better immune recovery.

Table no.3 and graph 1 depicts that among these 4 CD4 cells counts strata, on Pre ART maximum 95 (35.32%) patients had CD4 cells counts between 200-350 range. Total 180 (67%) patients had less than <350 CD4 counts and 89 patients had more than >350 CD4 cells counts at the time of Baseline examination. Post ART after 6 months there was increase in number of patients from 89 to 149 (69+80=149; 55.39%) with >350 CD4 cells range, this is further increase to 205 (76+129=205; 76.21%) after 12 months of ART. The number of patients had less than <200 CD4 cells counts reduced from 85 (31.60%) patients at baseline to 15 (5.58%) patient at 12months of ART. (p value between pre and post groups, $p < 0.0001$ significant). It is because of that the factors associated with increased CD4 cell count gains from month to years included lower pre-therapy CD4 cell count, younger age, female sex and infrequent low level viremia. This could be because of good response among patients with CD4 counts, and possibly good thymic function. we found in our studies that, patients with baseline CD4 cell counts of >350 cells/ μ l had significantly lesser chances of immunological non response compared to those with lower baseline CD4 cell counts. These findings are in accordance to the previous studies Gelba barasa S et al¹¹ and Advani et al¹².

Table 4 as showed the number of patients with an increase in CD4 counts were seen in 224 (83.27%) patients, whereas 45 (16.73%) patients had a decrease in CD4 counts after 6 months of Post ART. Post ART of 12 months patients were increased to 241 (89.59%) and 1 (0.37%) patient was static. Still there was decrease in CD4 counts in 27 (10.04%) patients so our study is similar to Ormaasan et al¹³ and Dravid N et al¹⁴ who had also reported poor CD4 cell recovery or no increase in CD4 count in a few patients

on ART in their studies. Patients showing decrease in CD4 count should be investigated for viral load and drug resistance studies. Reasons for lowering count may be non-adherence, lack of support from families, shortage of drugs and toxicity of drugs whereas CD4 count enhancement showed a Successful long-term ART results in a gradual recovery of CD4+ T-cell numbers and an improvement of immune responses and T-cell repertoire. Highleyman et al¹⁵ had also reported poor CD4 cell recovery or no increase in CD4 count in a few patients on ART in their studies. So we have to separately evaluate the patients who showed rise and those who showed fall in CD4 count after ART to get the true picture.

CONCLUSION

The CD4 count is the hallmark surrogate marker for assessing prognosis in HIV infected patients. Low baseline CD4 count at entry to an ART programme was associated with increased risks of morbidity and mortality. In untreated cases, CD4 counts decline and symptoms and Opportunistic infections appear whereas after ART, patients that respond to treatment show consistent and sustained increase in CD4 count and improvement in clinical symptomatology. This will help clinicians and policy makers determine the point to start treatment and the percentage of infected patients requiring treatment at registration using the count of CD4 as a tool. We have found that the baseline CD4 count trends are improving both for men and women but a lot needs to be done. So the programme needs to ensure that maximum number of patients are tested for HIV and linked to the ART centres. We conclude that CD4 cell count is a better prognostic test as it is simple, easy, reliable, convenient and less skill and staff required.

Limitation

The one of the limitations is, this study is age restricted and was conducted on patients who are >15years of age. Pregnant females

were also not included in this study. Second limitation is that Sample size and geographical area. Another was First and second wave of covid-19 hampered my sample collection and testing.

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Conflict of Interest: None

Ethical Approval: Approved

REFERENCES

1. UNAIDS FACSHEET 2017. Available from <https://www.unaids.org/en/resources/factsheet/> accessed on 9.10.2022
2. Solomon VS and Aylur Kailasam G. HIV in India: International AIDS Society–USA Topics in HIV Medicine.2002;10(3).
3. National AIDS Control Organization (2021). Sankalak: Status of National AIDS Response (Third edition, 2021). New Delhi: NACO, Ministry of Health and Family Welfare, Government of India.
4. Akinbami A, Dosunmu A, Adediran A. CD4 Count Pattern and Demographic Distribution of Treatment-Naive HIV Patients in Lagos, Nigeria. Hindawi Publishing Corporation AIDS Research and Treatment. 2012; Article ID 352753:1- 6. doi:10.1155/2012/352753.
5. Luckheeram RV, Zhou R, Verma D V, Xial B. CD4+T Cells: Differentiation and Functions .Hindawi Publishing Corporation Clinical and Developmental Immunology. 2012, Article ID 925135, 1-12. doi:10.1155/2012/925135.
6. Salunke P and Hora S. The Role of CD4 Count in Determining Prognosis in HIV Infected Persons on Antiretroviral Therapy. International Jour. Curr. Microbiol. App. Sci. 2021;10(02):3545-3551. doi: <https://doi.org/10.20546/ijcmas>.

7. Haokip P, Singh RH, Laldinmawii G, Marak KE, Roy A. Quantification of HIV-1 Viral load and its correlation with CD4 cell count in ART naïve patients attending Regional Institute of Medical Sciences Hospital, Imphal. *J Med Soc.* 2018; 32: 298-102.
 8. Mugo C.W., Shkedy Z, Mwalili S, Awoke T, Wandede D and Mwachari C. Modelling trends of CD4 counts for patients on antiretroviral therapy (ART): a comprehensive health care clinic in Nairobi, Kenya. *BMC Infectious Diseases*; 2022; 22: 29 <https://doi.org/10.1186/s12879-021-06977-w>
 9. Panda J, Vyas N, Mishra A, Sharma B. Correlation between CD4 Count and HIV-1 Viral Load among ART Naïve Patients Attending ICTC, SMS Medical College, Jaipur. *Int J Med Res Prof.* 2019; 5(4):282-84. Available from doi:10.21276/ijmrp.2019.5.4.069.
 10. Addisu A, Dagim A, Tadele E, Adissu A, Mussie A, Filmon K. CD4 Cell Count Trends after Commencement of Antiretroviral Therapy among HIV-Infected Patients in Tigray, Northern Ethiopia: A Retrospective Cross-Sectional Study. *PLoS ONE* 10(3):e0122583.
 11. Gelba barsa S, Fikadu S, Legesse kindie L, Wubet H et al. Assessment of pattern of CD4 T-cell recovery among human immunodeficiency virus patients after initiation of highly active antiretroviral therapy at arsi negelle health center, Ethiopia: A retrospective cross-sectional study. *HIV/AIDS-research and palliative care.* 2020; 12: 60-77.
 12. Advani M, Chandwani J, Rastogi VL and Meena CK. Assessment of cd4 cell count and viral load test in hiv-infected adults. *international journal of scientific research.* 2020; 9(11): 2277-8179. doi : 10.36106/ijsr.
 13. Ormaasan V, Bruun JN, Sandvik L, Holberg-Petersen M, Gaarder PI. Prognostic value of changes in CD4 count and HIV RNA during the first 6 months on Highly Active Antiretroviral Therapy in chronic Immunodeficiency Virus infection. *Scand J Infect Dis* 2003; 35: 383-8.
 14. N Dravid M, Khadse K R, Kulkarni SD, Adchitre HR. Two years CD4 count follow-up of rural patients on antiretroviral therapy: A study in Government Hospital. *Indian Journal of Sexually Transmitted Diseases and AIDS* 2011; 32(1): 59-60.
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