



CLINICAL PROFILE OF HIV PATIENTS AND ITS CORRELATION WITH SERUM ALBUMIN LEVEL AND CD4 COUNTS

Internal Medicine

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ABSTRACT

Background: Human Immunodeficiency Virus (HIV) is a critical global health issue that compromises the immune system by predominantly attacking CD4+ T cells, macrophages, and dendritic cells, leading to immunodeficiency and increased susceptibility to opportunistic infections and certain cancers. This study investigates the clinical profile of HIV patients and the relationship between serum albumin levels and CD4 counts, which are key markers of immune function and disease progression. **Methods:** A cross-sectional observational study was conducted at Assam Medical College and Hospital in Dibrugarh from July 2021 to June 2022. It included HIV-infected patients aged 13 years or older who provided informed consent. Exclusion criteria were pre-existing conditions affecting serum albumin levels. Detailed clinical history, physical examinations, and relevant laboratory investigations, including complete blood counts, liver function tests, renal function tests, serum albumin, and CD4 counts, were collected and analysed. **Results:** Out of 140 patients, the majority were males aged 30-49 from low socioeconomic urban areas. Common clinical manifestations included fever, weight loss, chronic diarrhoea, tuberculosis, and oral thrush. The study found a significant positive correlation between serum albumin levels and CD4 counts ($r=0.932$, $p<0.001$). Higher serum albumin levels were associated with higher CD4 counts, indicating better immunological status. Conversely, low serum albumin levels correlated with lower CD4 counts and more advanced stages of HIV disease. **Conclusion:** Serum albumin levels show a strong positive correlation with CD4 counts among HIV patients, suggesting that serum albumin can serve as a surrogate marker for immune function and disease progression. This finding is particularly valuable in resource-limited settings, where regular CD4 testing may not be feasible. Routine monitoring of serum albumin levels could enhance HIV management and patient outcomes through timely nutritional and therapeutic interventions.

KEYWORDS

HIV clinical profile, serum albumin and CD4 correlation, HIV prognostic markers

INTRODUCTION

Human Immunodeficiency Virus (HIV) is a global health challenge. It disables the immune system by targeting mainly CD4+ T cells, macrophages, and dendritic cells. Depletion of CD4+ cells lead to immunodeficiency and eventually predisposes the patient to opportunistic infections and some cancers.(1) This research work directs its attention to the clinical profile of patients with HIV and investigates the relation between serum albumin levels and CD4 counts, which are two very important markers of immune function and disease progression.

Since its isolation in the early 1980s, HIV has caused a pandemic that has led to immense mortality and morbidity globally.(2) Even though antiretroviral therapy has revolutionized the life expectancy and quality of life of patients infected with this virus, it remains a highly problematic virus to manage and monitor, in resource-restricted environments.(3) In fact, the expected relationship of dynamics between the level of serum albumin and the CD4 count has the potential to provide an estimate of immense importance in the management of the disease and in relation to patient outcomes in these cases.

Aims and Objectives

Aim:

To investigate the relationship of serum albumin with CD4 counts in HIV positive patients

Objectives:

- 1) To estimate serum albumin and CD4 counts in HIV patients presenting to Assam Medical College and Hospital, Dibrugarh.
- 2) To correlate serum albumin level with CD4 counts and clinical profile of HIV patients.

MATERIALS AND METHODS

Study Design and Setting

This was a cross-sectional observational study involving >13 years old patients and was carried out at Assam Medical College and Hospital of Dibrugarh over a period of one year, from July 2021 to June 2022.

Patients attending the ART Centre/OPD/Inpatient wards of the hospital. The study was designed to collect comprehensive data about the clinical profile of patients and correlate serum albumin with the CD4 counts.(4)

Inclusion and Exclusion Criteria

Inclusion criteria consisted of HIV-infected patients of 13 years or more who gave informed written consent.(5)

Exclusion criteria: Patients with pre-existing hepatobiliary, renal or gastrointestinal diseases affecting serum's albumin levels, congestive cardiac failure or recent burns, and deferred consent were excluded from the participation in the study. This aided in focusing the study on the relationship of serum albumin with CD4 counts without any interference of confounding factors that could affect the study.

Ethical Clearance

The project was approved by the Institutional Ethics Committee, Assam Medical College and Hospital, Dibrugarh. The informed written consent was obtained from all participants, and the ethical practice standards along with maintaining the confidentiality of the patient conditions were followed. The ethical clearance ensures that the study obeys all guidelines protecting the rights and welfare of participants.(6)

Data Collection(7)

A detailed clinical history, physical examination, and relevant investigations were carried out in all newly diagnosed cases of HIV. The details were recorded in a predesigned proforma. Data regarding demographic details, presence of clinical symptoms, laboratory results, and history of opportunistic infections were all recorded/investigated. Investigations taken included complete blood counts, liver function tests, renal function tests, serum albumin, and CD4 counts. The clinical history includes the duration of symptoms, past medical history, and previous ART taken.

The physical examination was meticulous, looking for any opportunistic infections, nutritional status, and other complications of

HIV infection. The diagnostic investigations for establishing the diagnosis of hypoproteinaemia were standardized using classical and result-based methods, with the exclusion of all conditions that could also affect albumin levels, such as liver disease and renal dysfunction.

Statistical Analysis

The statistical analysis was carried out by the Statistical Package for Social Sciences, SPSS for Windows, version 21.0 Chicago; SPSS inc. using the relevant applied tests, which includes the student's t test, ANOVA, Fisher's exact test, Chi-square test, and Pearson correlation coefficient. p value of less than 0.05 is considered significant. All data were presented in graphs and tables prepared on Microsoft word and Excel. Correlation analysis was carried out to explore the relationship that existed between the serum albumin levels and CD4 counts and the correlation between serum albumin levels vs the stages of HIV disease. The p-value less than 0.05 was taken statistically significant showing a strong relationship between the variables.(8)

RESULTS

Demographic Profile

Of the 140 patients who were diagnosed with HIV, a good number of them were males aged 30 to 49, living in low socioeconomic status urban areas. The demographic distribution therefore indicates that public health interventions and resource factors applicable to the management of HIV should be focused on these populations. Further, awareness of the demographic profile will tailor interventions and resources to the most affected groups.(2,9)

Table 1: Sociodemographic characteristics of the study population

Parameter	Frequency (n=140)	Percentage (%)
Gender(male)	98	70
Gender (female)	42	30
Age group (30-49)	89	63.57
Urban residence	104	74.29
Low socio-economic status	112	80

Clinical Presentations

The typical clinical manifestations found in all these patients were fever, weight loss, chronic diarrhoea, and opportunistic infections such as tuberculosis and candidiasis. The common oral manifestations were thrush and leucoplakia. Most of these symptoms correspond to the classical presentation of HIV patients, which stresses on the necessity of early diagnosis and management to prevent severe complications. It also corresponds to advanced immunosuppression reflected by the presence of such symptoms, hence requiring regular monitoring for the same and early initiation of ART.(10)

Table 2: Clinical manifestations in the study population

Symptoms	Frequency(n=140)	Percentage (%)
Fever	95	67.86
Weight loss	78	55.71
Chronic diarrhoea	45	32.14
Tuberculosis	38	27.14
Oral thrush	34	24.29
Leucoplakia	29	20.71

Table 3: Serum albumin versus CD4 counts in the study population

	S. Albumin levels (g/dl)							r value	P value
	≤1.5	1.6-2.0	2.1-2.5	2.6-3.0	3.1-3.5	3.6-4.0	≥4.1		
≤50	1	7	0	0	0	0	0	0.93	<0.001
51-100	2	4	2	0	0	0	0	2	
101-200	0	4	32	2	1	0	0		
201-300	0	0	5	40	1	0	0		
301-400	0	0	1	5	15	0	0		
401-500	0	0	0	0	1	5	3		
>500	0	0	0	0	0	4	5		
Total	3	15	40	47	18	9	8		

The study showed a positive correlation between the level of serum albumin and the CD4 count in T-Cell. In other words, the higher the serum albumin, the higher the count in T-Cell CD4, which would imply better immunological status and a lower class of severity disease. On the contrary, xerostomia accompanied by a low serum albumin level correlated with low CD4 count and a higher class of disease. It could be concluded that serum albumin may possibly be a useful biomarker for

monitoring HIV progression and guiding treatment.(11)

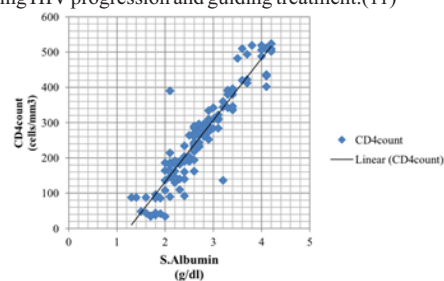


Fig 1: Scatter diagram of correlation between serum albumin and CD4 counts in the study population

From the scatter diagram, it is evident that serum albumin has a direct relationship with CD4 counts, vouching for the use of serum albumin as a surrogate marker to HIV progression. The graphical presentation is easy to understand the pattern and the strength of the correlation of the two variables.(11)

Table 4: Serum albumin versus stages of HIV disease

STA	Serum Albumin(g/dl)							r value	P Value
GE	≤1.5	1.6-2.0	2.1-2.5	2.6-3.0	3.1-3.5	3.6-4.0	≥4.1		
1	0	0	0	0	0	2	2	-0.526	<0.001
2	0	0	0	2	0	3	2		
3	1	10	19	32	17	4	4		
4	2	5	21	13	1	0	0		
Total	3	15	40	47	18	9	8		

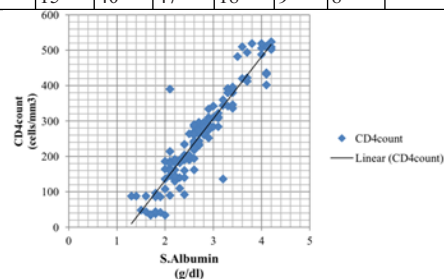


Fig 2: Scatter diagram showing negative correlation between serum albumin and stage of HIV disease

The above table and scatter diagram shows that a lower serum albumin shows significant correlation with a higher stage of disease.

DISCUSSION

Pathophysiology of Albumin Levels in HIV Patients

Albumin is the most abundant plasma protein synthesized in the liver; it plays a very important role in maintaining the oncotic pressure and acts as a transport protein for numerous substances, including hormones, vitamins, and drugs. Several factors account for hypoalbuminemia in a HIV patient: chronic inflammation that may act to inhibit the synthesis of albumin; increased vascular permeability with loss of albumin; and often, nutritional deficiencies in advanced HIV disease.(1)

Chronic inflammation in HIV results from continuous activation of the immune system because of the virus and related opportunistic infections. The latter may decrease liver function in the production of albumin. Secondly, there may be direct inhibition of albumin production by the inflammatory cytokines, such as TNF-alpha and IL-6. Increased intestinal permeability and protein loss across the gastrointestinal tract, exposed to increased lymphoid tissues, are common among people with HIV, further lowering the levels of albumin.(11-13)

The hypermetabolic state, in many cases reported in HIV-positive patients, can exacerbate hypoalbuminemia in which increased energy expenditure and protein catabolism advance nutrient intake. This is confounded further by opportunistic infections and other comorbidities, which further increase the metabolic demand at the same time adding to the protein loss.

Positive Findings from this Research

This study adheres to the view that serum albumin is a good marker for immune function in HIV patients through the significant positive correlation between the levels of serum albumin and CD4 counts. The findings support previous studies relating hypoalbuminemia to advanced HIV disease and worse clinical outcome.

1. Correlation Between Albumin and CD4 Counts: The patients who had higher serum albumin levels had significantly higher CD4 counts. This allows inference that the serum albumin could work as a surrogate marker for immune status—a cost-effective, more accessible way of following the course of disease in patients whose follow-up with regular CD4 testing is not possible.(11,14)

2. Clinical Implications: Assays of serum albumin should help identify, relatively early, those patients who are at increased risk of experiencing a more rapid disease progression. It may prompt timely interventions with nutritional support and further optimization of antiretroviral therapy to optimize patient outcome.

3. Utility in Resource-Limited Settings: Quantification of serum albumin may be a relatively cheap and abundant test. Its inclusion in the list of tests routinely monitored in HIV care may provide better management of the disease, especially in resource-limited settings where access to comprehensive laboratory facilities is limited.

4. Reinforcement of Previous Studies: The study adds to a growing body of literature that supports the use of serum albumin as a marker of prognosis in HIV. It also illustrates the possibility of serum albumin becoming a universal marker by showing this in an Indian setup.(11,14)

5. Nutritional Interventions: Hypoalbuminemia is one of the markers to be corrected by dietary supplementation, which can possibly contribute to better outcomes for patients through the reversal of hypoalbuminemia, improved immune function, and subsequent overall health for the HIV.

6. Generalizability: Serum albumin can, in addition, be used to predict progression to AIDS, but could also be used to predict other relevant clinical outcomes in HIV, for example, opportunistic infection risk and all-cause mortality—which would require further study in larger and more diverse cohorts.

CONCLUSION

Serum albumin levels are strongly correlated with CD4 counts among HIV patients and therefore become a surrogate marker of disease progression. Serum albumin levels monitoring thus may have role in assessment of clinical status and thereby guiding management of HIV patients. This may be a more feasible approach in resource-limited settings, since comprehensive facilities for laboratory-based studies are not usually easy to come by.

Such measurements of serum albumin should be incorporated in routine HIV care for optimal monitoring and, thereby, timely interventions to improve outcomes. Future studies should aim to replicate these results in larger HIV cohorts and further investigate the potential for serum albumin to predict other clinical outcomes in HIV patients.

Finally, health policies need to take this into consideration: make serum albumin testing routine care for all patients with HIV infection. This practice could ensure a more holistic approach to managing HIV infections, especially among low-resource healthcare settings. Besides, enhanced emphasis in the provision of nutritional support and management of chronic inflammatory conditions can further help optimize the quality of care and outcomes.

REFERENCES

1. Blanchet, F. P., Moris, A., Nikolic, D. S., Lehmann, M., Cardinaud, S., Stalder, R., et al. (2010). Human immunodeficiency virus-1 inhibition of immunoamphisomes in dendritic cells impairs early innate and adaptive immune responses. *Immunity*, 32(5), 654–69.
2. UNAIDS. (2021). Global HIV & AIDS statistics - 2021 fact sheet.
3. Palella, F. J., Delaney, K. M., Moorman, A. C., Loveless, M. O., Fuhrer, J., Satten, G. A., et al. (1998). Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection. *New England Journal of Medicine*, 338(13), 853–60.
4. Capili, B. (2021). Cross-sectional studies. *AJN American Journal of Nursing*, 121(10), 59–62.
5. World Health Organization. (2020). Consolidated guidelines on HIV testing services, 2019: Web annex E. HIV testing strategies performance: Considerations for global guideline development (No. WHO/UCN/HHS/19.44). World Health Organization.

6. Belmont, R. (1979). Ethical principles and guidelines for the protection of human subjects of research. Washington, DC: Supt. of Government Documents, pp. 1-11.
7. Chandler, R. K., Kahana, S. Y., Fletcher, B., Jones, D., Finger, M. S., Aklin, W. M., et al. (2015). Data collection and harmonization in HIV research: The Seek, Test, Treat, and Retain Initiative at the National Institute on Drug Abuse. *American Journal of Public Health*, 105(12), 2416–22.
8. Field, A. (2024). *Discovering statistics using IBM SPSS statistics*. Sage Publications Limited.
9. National AIDS Control Organization (NACO). (2019). India HIV estimation 2019.
10. Patel, M. (2020). Clinical manifestations of HIV infection. *Journal of Medical Virology*, 92(8), 1542–1551. <https://doi.org/10.1002/jmv.25711>
11. Balgi, V., Arun, Nayak, V., Suneetha, D. K., & Prashantha, B. (2019). Study of serum albumin level in subjects with HIV infection, in relation to CD4 count, as a marker of immune suppression. *International Journal of Contemporary Medical Research*, 6(12), L1-L3.
12. Riedel, S., Hobden, J. A., Miller, S., Morse, S. A., Mietzner, T. A., Detrick, B., et al. (Eds.). (2019). *Jawetz, Melnick & Adelberg's medical microbiology* (28th ed.). New York, NY: McGraw-Hill Education.
13. Loscalzo, J., Fauci, A. S., Kasper, D. L., Hauser, S. L., Longo, D. L., Jameson, J. L., et al. (2022). *Harrison's principles of internal medicine* (21st ed., International ed.). New York: McGraw-Hill.
14. Mehta, N., & Banarjee, S. (2024). Correlation of serum albumin and CD4 count as a marker of immunosuppression in patients living with HIV: A comparative study. *Journal of Population Therapeutics and Clinical Pharmacology*, 31(1), 2016–2021. <https://doi.org/10.53555/jptcp.v31i1.4292>