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Cardiovascular Manifestations of People Living with HIV/AIDS: A Report from a Tertiary Care Hospital

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Abstract

BACKGROUND: To study the profile and characteristics of cardiovascular abnormalities among PLWHA (patients living with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) at a tertiary care hospital in India. The association of cardiovascular abnormalities with the CD4 count and disease stages, according to the World Health Organization (WHO) classification, was also analyzed**.**

METHODS: A total of 200 [diagnosed as per the NACO criteria] were compared with 50 healthy controls. The predominantly young cohort of our study represents the HIV/AIDS population of India patients with HIV/AIDS. All patients underwent blood investigations, chest X-ray, electrocardiography, echocardiography, High sensitive NT pro BNP

RESULTS: The mean age of the patients was 38.66 ± 9.22 years, with a male-to-female ratio of 3.25:1. Echocardiographic abnormalities were found in 52% of the patients and 12% of the controls, with the most common abnormality being left ventricular diastolic dysfunction. Echocardiographic abnormalities were markedly more common in patients with a CD4 count of <200/mL The advanced stage of the disease, according to the WHO classification, was also associated with an increased incidence of echocardiographic abnormalities.

CONCLUSION: Cardiovascular abnormalities in the form of electrocardiogram and ECHO findings were present in 54.5% and 52% of patients, respectively. Echocardiographic findings showed significant correlation with CD4 count and WHO disease stage.

KeyWords: ECHO, CD4 COUNT, PLWHA (patients living with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS).

INTRODUCTION

Acquired immunodeficiency syndrome (AIDS) is one of the Deadliest diseases of the current era. With ncreasing global access to antiretroviral therapy and an aging population with human immunodeficiency

virus (HIV), the burden of cardiovascular disease among people with HIV has tripled over the last two decades and continues to increase worldwide [1].

Causes of these diseases are multifactorial. Both HIV-specific mechanisms and traditional risk factors contribute to the increased burden of cardiovascular disease. Because of the complexity and multiple underlying mechanisms, we consider HIV to be a risk-enhancing factor when considering an individual's predicted cardiovascular risk

Even when treated, HIV is associated with increased risk for cardiac and vascular diseases compared to people without HIV, including increased risk of atherosclerotic cardiovascular disease, heart failure, and arrythmias [2]

People with HIV who develop heart disease have worse long-term prognoses compared to people without HIV.

As an example, in a meta-analysis of over 2 million individuals with prior acute coronary syndromes or percutaneous coronary intervention, people with HIV had 64 percent higher risk of mortality, 11 percent higher risk of major adverse cardiovascular events, 83 percent higher risk of recurrent acute coronary syndromes, and 39 percent higher risk of new heart failure [3].

Similarly, in another study, people with HIV and heart failure had 55 percent higher risk of all-cause mortality compared to people with heart failure without HIV [4].

While outcomes may be even worse among people with uncontrolled HIV, these estimates largely represent people with treated HIV on ART.

There is a paucity of data regarding the cardiovascular manifestations of HIV in India, despite having a substantial Number of PLHA. Therefore, we conducted this study at a tertiary Care hospital in Vishakhapatnam district of Andhra Pradesh to assess the cardiovascular manifestations in PLHA.

Drug-drug interactions between ART regimens and cardiac medications is the Most important consideration when managing cardiac and vascular diseases in People with HIV. Many commonly used ART drugs, including integrase strand Transfer inhibitors such as bictegravir and dolutegravir, have minimal drug-Drug interactions. However, boosted protease inhibitors (eg, darunavir withRitonavir) are associated with many drug-drug interactions

AIMS AND OBJECTIVES:

The purpose of this study is to evaluate the mode of presentations, clinical profile, and spectrum of target organ damage in patients presenting with hypertensive crisis.

METHODS AND MATERIALS:

Patients admitted in Department of General Medicine at King George hospital Visakhapatnam. After applying the inclusion and exclusion criteria, out of 320 patients, 120 patients were excluded, And 200 patients were found eligible for the study.

Study design:

Hospital Based observational, cross-sectional, prospective study.

Inclusion criteria:

1. Patients above 18 years of age
2. All patients (age >18 years) who were diagnosed with HIVInfection, as per the NACO guidelines (by COMBAIDS dot immuNoassay test, HIV ½ triline rapid test, PAREEEKSHAK HIV ½ spotrapid test) and attended the antiretroviral therapy clinic were Included in this study.

Exclusion criteria:

1. Patients less than 18 years of age.
2. Patients who were diagnosed with

A) congenital heart disease,
B) ischemic heart disease (IHD),
C)rheumatic heart disease, cardiomyopathy,
D)systemic or pulmonary hypertension, or chronic respiratory Disease before HIV diagnosis were excluded.

Study protocol:

Over a period of 1 year, information was acquired from 200 patients admitted to the hospital between february2024 to January 2025.

All of these Patients were interviewed with a structured questionnaire Regarding complaints with duration, personal history (occupation, Smoking, sexual activity, drug abuse, etc.), comorbidities, and other Relevant information followed by thorough clinical examination.

50 age-matched and sex-matched healthy HIV negative volunteers without any cardiovascular risk factors or comorbidities were Selected as controls.

All patients underwent routine hematological, biochemical Investigations, enzyme-linked immunosorbent Assay based method was used to detect the serum N-terminal pro brain natriuretic peptide level, CD4 count, chest X-ray (posteroanterior view) and electrocardiograms (ECGs), 2D ECHO Were obtained. The controls underwent all investigations except CD4 Count.

Statistical analysis;

Data were compared for statistical analysis using the Fisher's test, Chi-square test, student t-test, and analysis of variance, as Appropriate. A P value <0.05 was Considered statistically significant.

RESULTS:

A total of 200 PLHA were studied. The mean age of the study population was 38.66 ± 9.22 years (range: 21-55 years). Most of the patients (49%) were in the age group of 31-40 years (Fig. 1). Of 200 patients, 153 were male (male: female ratio: 3.25:1). The mean ages of male and female patients were 40.2 ± 10.26 and 33.5 ± 7.38 years, respectively.

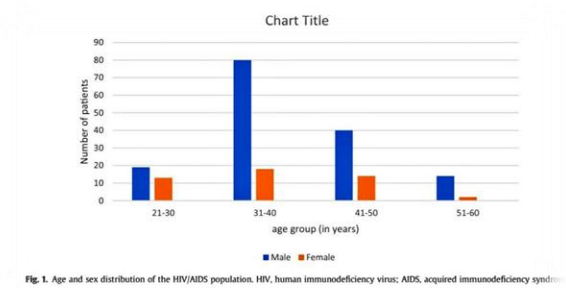

Fig. 1. Age and sex distribution of the HIV/AIDS population. HIV, human immunodeficiency virus; AIDS, acquired immunodeficiency syndr

Sexual mode (heterosexual contact) was the most common transmission route detected in 93% of all cases. Other modes of transmission included blood transfusion (4%) and intravenous drug abuse (0.5%); however, the mode of transmission could not be ascertained in 2.5% of patients

Approximately 37% of patients were smokers, 23.5% were alcoholic, and 17% were addicted to both smoking and alcohol. Only one patient revealed a history of intravenous drug abuse. A staggering 41.2% of the male patients (63 out of 153) were migrant laborers by profession.

The range of CD4 count was 34-674/mL (mean, 239.45 ± 150.2/mL). The CD4 count was less than 50/mL in 30% of cases, between 50 and 199/mL in 40% of cases, between 200 and 499/mL in 16% of cases, and >500/mL in 14% of cases. About 87.5% of male patients were in clinical stage III and IV, whereas 80% of females were in clinical stage II and III. Of all patients, 54% were on treatment with HAART, and the remaining were either newly diagnosed cases or did not satisfy the NACO criteria for HAART initiation. All patients receiving treatment were prescribed first-line triple drug antiretroviral therapy. Regarding significant medical history, hypertension, diabetes mellitus, dyslipidemia, and tuberculosis were present in 10%, 8%, 13%, and 7% of cases, respectively. The most common symptom possibly related to CVD was cough (42%), followed by fever (33%), breathlessness (27%), and chest pain (12%).

cardiovascular abnormalities were observed on chest X-ray, ECG, and echo in 16 (8%), 109 (54.5%), and 104 (52%), respectively. While in the control population were 3 (6%), 10 (20%), and 6 (12%), respectively.

Table 1

ECG abnormalities	CD4<50/mL (n ¼ 60)	CD4 50e199/mL (n ¼ 80)	CD4 200e499/mL (n ¼ 32)	CD4>500/mL (n ¼ 28)	P value
Sinus tachycardia	14	23	8	5	0.69
Conduction abnormalities	1	1	1	2	0.35
Atrial ectopics	2	1	1	1	0.83
Ventricular ectopics	1	1	2	1	0.44
Poor progression of R wave	2	2	1	1	0.98
Low voltage	8	10	5	3	0.95
ST/T wave abnormality	6	8	6	4	0.65

Serum NT-pro BNP level was obtained only in 108 patients, and the value above the cutoff was detected in 50 (46.3%) patients and two (9%) controls

The most common ECG abnormality was sinus tachycardia (n= 50; 45.8%) followed by low voltage QRS complex (23.8%) and ST-T wave changes (20.2%).There was no significant correlation between the ECG findings and CD4 count. When divided depending on the disease stages (WHO classification), ECG findings were similar for different disease stages (Table 2).

Table 2

ECG Abnormalities	WHO CLASS I (n ¼ 23)	WHO CLASS II (n ¼ 28)	WHO CLASS III (n ¼ 71)	WHO CLASS IV (n ¼ 78)	P value
Sinus tachycardia	3	4	18	25	0.13
Conduction abnormalities	1	2	1	1	0.30
Atrial ectopics	1	1	1	2	0.84
Ventricular ectopics	1	1	2	1	0.81
Poor progression of R wave	1	1	1	3	0.80
Low voltage	3	3	6	14	0.37
ST/T wave abnormality	4	3	5	12	0.36

Compared with 12% of controls, 52% of patients exhibited echocardiographic abnormalities[Table 3]

Table 3

Echocardiographic abnormality	Cases (n ¼ 200)	Controls (n ¼ 50)	P value
LV diastolic dysfunction	78 (39%)	4 (8%)	<0.0001
Valvular regurgitation (MR, AR, PR, TR)	61 (30.5%)	5 (10%)	0.002
Reduced FS(<30%)	64 (32%)	2 (4%)	<0.0001
Reduced LVEF	32 (16%)	2 (4%)	0.035
Dilated cardiomyopathy	24 (12%)	1 (2%)	0.035
Pulmonary hypertension	30 (15%)	3 (6%)	0.106
Regional wall motion abnormality	2 (1%)	0 (0%)	1.0
Pericardial effusion	14 (7%)	0 (0%)	0.079

The most common echocardiographic abnormality was LVDD. Of all patients with LVDD (n ¼ 78), 50 (64%) had mild, 24 (31%) had moderate, and 4 (5%) had severe diastolic dysfunction.
Of 14 cases of pericardial effusion, eight had mild, four had moderate, and two had
massive effusion
Reduced FS, LVDD, reduced LVEF (<50%), valvular regurgitation, and pericardial effusion were significantly more common in patients with a CD4 count < 200/mL (Table 4). Similarly, there were significant differences in diastolic dysfunction, reduced FS, reduced EF, and valvular regurgitation between various disease stages[Table 5]

TABLE 4

Severity of diastolic dysfunction	CD4<50/mL (n ¼ 60)	CD4 50e199/mL (n ¼ 80)	CD4 200e499/mL (n ¼ 32)	CD4 >500/mL (n ¼ 28)	P value
Normal	25 (41.7%)	42 (52.5%)	27 (84.4%)	23 (82.1%)	0.003
Mild	22 (36.7%)	20 (25%)	4 (12.5%)	4 (14.3%)	
Moderate	10 (16.7%)	17 (21.2%)	1 (1.5%)	1 (2.3%)	
Severe	1 (4.9%)	1 (1.3%)	1 (1.5%)	1 (2.3%)	

Echocardiographic abnormality	CD4<50/mL (n ¼ 60)	CD4 50-199/mL (n ¼ 80)	CD4 200e499/mL (n ¼ 32)	CD4 >500/mL (n ¼ 28)	p value
LV diastolic dysfunction	30	36	8	4	0.003
Valvular regurgitation (MR, AR, PR, TR)	20	24	14	3	0.045
Reduced FS(<30%)	10	42	8	4	<0.00001
Reduced LVEF (<50%)	6	20	3	3	0.045
Dilated cardiomyopathy	5	15	2	2	0.119
Pulmonary hypertension	9	15	5	1	0.288
Regional wall motion abnormality	0	2	0	0	0.387
Pericardial effusion	4	10	0	0	0.041

TABLE 5

TABLE 6

Echocardiographic abnormality	WHO CLASS I (n ¼ 23)	WHO CLASS II (n ¼ 28)	WHO CLASS III (n ¼ 71)	WHO CLASS IV(n ¼ 78)	P value
LV diastolic dysfunction	5	6	30	37	0.02
Valvular regurgitation (MR, AR, PR, TR)	4	3	24	30	0.02
Reduced FS(<30%)	4	3	24	31	0.01
Reduced LVEF (<50%)	3	3	6	20	0.02
Dilated cardiomyopathy	3	3	6	12	0.62
Pulmonary hypertension	6	7	7	10	0.10
Regional wall motion abnormality	1	0	0	1	0.78
Pericardial effusion	2	4	3	5	0.35

Compared with 82.1% of patients with the highest CD4 count, 41.7% of patients with the lowest CD4 count showed normal diastolic function[5]. The difference in LVDD between the groups was statistically significant (p ¼ 0.003] table 6

Serum NT-pro BNP level was obtained only in 108 patients, and the value above the cutoff was detected in 50 (46.3%) patients and two (9%) controls

DISCUSSION:

This study was conducted in 200 PLHA diagnosed as per the NACO criteria. The predominantly young cohort of our study rep-

resents the HIV/AIDS population of India[FIG.1]

A North Indian study reported that the mean ages of male and female patients are37.13 ± 8.80 years and 32.35 ± 5.14 years, respectively.[6] A cross-sectional study of 60 HIV positive patients found that 53.3% of

patients are in the 31-40 years age group, with males constituting 63.3% of the population

Most of the migrant laborers from Ganjam

district were male and in the productive age group, which is in line with the above findings. In contrast, a recently published international meta-analysis involving 54 studies has revealed that the average age of patients is 47 years

Cough and fever were the two most common symptoms in our study patients, which is in line with the findings of previous

studies [7]

Chest X-ray revealed cardiomegaly in 8% of cases, which is similar to the findings of Akinbami et al. [8] However, this finding was not significant when compared with controls.

ECG and echocardiography related abnormalities were more common in PLHA than in controls; in addition, serum NT-pro BNP levels were higher in PLHA than in controls. The presence of ECG abnormalities in 54.5% of patients indicated that ECG can be used as an easy and convenient tool for investigating CVD risk.

A similar conclusion has been drawn by a study involving 75 PLHA (49.3%).

Lipschultz et al. have also revealed that 57% of asymptomatic PLHA show ECG abnormalities.[9]

A study from Tamil Nadu reported that low voltage QRS complex is the most common ECG abnormality (27.27%), whereas poor progression of R waves has been reported to be the most common ECG abnormality by
Sundarrajan et al.[10]
In the present study, there was no significant correlation between the ECG findings and CD4 count. This is consistent with the recent results obtained byA)Sharma et al [11]
B) and Kumar et al.
C)Chaudhary et al. have also made similar conclusion when comparing the two groups of patients using a CD4 count cutoff of
350/mL.
Importantly, Soliman et al. demonstrated that the presence of ECG abnormalities is an independent predictor of CVD
incidences.
In addition, Sakthidavel et al. have found a strong relation between the CD4 count and ECG abnormalities (p ¼ 0.000).
There was no statistically significant association between the ECG abnormality and WHO class (Table 2). This is consistent with the findings of Chaudhary et al but contradictory to the findings of Sundararajan et al, which reports a significant increase in ECG abnormalities with the advancement of WHO class.
There is widespread agreement that the most important factor for the development of cardiac abnormalities is the level of immunosuppression; the present study also revealed a strong association between the echocardiographic findings and CD4 count. A study from Taiwan revealed that both systolic and diastolic dysfunctions are positively correlated with a decreased CD4 count.[12]
LVDD was the most common echocardiographic abnormality in our study population, similar to the findings of several previous studies involving Indian PLHA.[13]
Interestingly, a study by Nayak et al. have also reported a high prevalence (37%) of LVDD in a cohort of young (median age: 38 years) asymptomatic PLHA without any other risk factor for CVD.
Erquo et al. have reported that the pooled prevalence of grade I to grade III diastolic dysfunction is 29.3% and grade II to III diastolic dysfunction is 11.7%.
Sharma et al. have found that the most common echocardiographic manifestations are the reduction in EF and FS,pericardial effusions, dilated cardiomyopathy, and diastolic dysfunction.
DCM was more prevalent in PLHA than con-
trols (p ¼ 0.035). The prevalence of HIV is increasing in cardiomyopathy patients because of the increased lifespan after the
introduction of HAART
The severity of LVDD increases significantly with a decrease in CD4 count. This is in agreement with the findings of Mankwe et al.
who reported that 82.4% of patients with a CD4 count >500/mL have normal diastolic function, whereas only 52.5% of patients with a CD4 count <200/mL have normal diastolic function.[14]
In this study, severe diastolic dysfunction was found in 5.9% of patients with a CD4 count >500/mL and 27.5% of patients with a CD4 count <200/ mL. Similarly, Hidayat et al. have reported a significant correlation between low CD4 count and diastolic dysfunction grade
(p ¼ 0.002). A CD4 count <200/mL has been shown to strongly predict the diastolic dysfunction with an odds ratio of 9.35.

A meta-analysis by Erqou et al. revealed a trend of lower prevalence of advanced diastolic dysfunction in studies involving patients with a higher mean CD4 count.

In our study, pericardial effusion was noted in 7% of PLHA with a CD4 count of <200/mL. The effusion may be related to the opportunistic infections or malignancy, although a clear etiology could not be established in majority of the cases. The incidence of pericardial effusion in AIDS patients has been reported to be 11% per year, whereas the prevalence of symptomless effusion has been estimated to be 22% Pericardial effusion has often been considered a marker of end-stage disease because it is associated with a low CD4 count.

Sakthivadivel et al. have demonstrated that the incidence of echocardiographic abnormalities increases in patients with a CD4

count <350/mL. Sundarrajan et al. have reiterated this principle in

a recently published study involving 100 patients.[15]The advanced disease stage also significantly correlated with the echocardiographic findings.

Khunnawat et al. and Zareba and Lipshultz have reiterated that cardiac manifestations occur at the later stages of disease. Sundarrajan et al. have also revealed a strong

association between the disease stages and echocardiographic manifestations (p ¼ 0.00), indicating that cardiac abnormalities are

directly proportional to the disease stage.14

Hence, an early diagnosis of the disease can potentially prevent cardiovascular

complications.

Limitations:

Only 200 PLHA were evaluated at a single time point. No follow-up was done.

The relation between the cardiac abnormalities and HAART was not

assessed.

Serum NT-pro BNP levels were obtained for only 54% of

cases.

There was no independent adjudication of echocardiographic

findings.

Exercise stress testing and coronary angiography were not included in our study protocol, which resulted in an incomplete

evaluation of IHD.

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