



Assessment of Cardiac Autonomic Dysfunction in Newly Diagnosed HIV/AIDS Patients and Its Association with CD4 Count

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Abstract

Background: HIV remains a global epidemic, affecting 38 million people, with significant mortality & morbidity. 1.7 million new infections & 0.69 million AIDS-related deaths occurred in 2019. India, with 2.1 million cases in 2017, ranks third globally, with Karnataka exhibiting a prevalence of 0.47%. Autonomic nervous system(ANS) dysfunction is prevalent among HIV-positive individuals, with varying degrees of severity.

Objectives: This study aimed to analyze the prevalence and characteristics in patients with newly diagnosed HIV who have cardiac autonomic dysfunction.

Methods: A cross-sectional investigation was carried out on 95 newly diagnosed HIV/AIDS patients at Sarojini Naidu Medical College's Department of Medicine in Agra, from January 2023 to June 2024. Ethical approval was obtained. Age ≥ 18 years & signed informed consent were prerequisites for inclusion. Patients who had known cardiovascular illnesses, substantial comorbidities, or both chronic & current alcohol misuse were excluded. SPSS version 23.0 was used to analyze data. Chi-square & ANOVA were among statistical tests used, & $P < 0.05$ was chosen as significance level.

Results: Most of patients were aged 20-30 years (51.6%), with males representing 72.7% of sample. Heterosexuals were most common typology (38.9%).

CD4 counts primarily ranged from 301-400 cells/ μ L(22.1%). Heart rate's (HR) reaction to standing up after lying down has been normal in 70.5% with 5.3% abnormal responses. 53.7% showing abnormal HR variation to Valsalva manoeuvre. Response of systolic BP to standing has been normal to 50.5% with 3.2% abnormality & response of diastolic BP to maintain a hand grip had been abnormal to 34.7%. Cardiac autonomic dysfunction was observed in 36.8%, with 37.9% displaying aberrant QT dispersion, although there was no discernible relationship to CD4 level.

Conclusion: In HIV patients, cardiac autonomic dysfunction is common, exacerbated by decreased CD4 counts & disease severity. Early identification & intervention are crucial to reducing morbidity & mortality from cardiac events in this population.

Keywords: HIV; Autonomic Dysfunction; CD4 Count; Cardiac Health; Antiretroviral Therapy; QT Dispersion.

Introduction

With 38 million infected, HIV is still a major worldwide health concern. 1.7million new infections & 0.69million deaths from AIDS-related causes were recorded in 2019.[1]. By mid-2020, 26 million were receiving antiretroviral therapy (ART). Since outbreak started, 32.7 million people have perished & 75.7 million have been sick from AIDS-related diseases. In 2017, India reported 2.1 million HIV cases, making it third most affected country globally, with a prevalence rate of 0.22%.[2] In Karnataka, prevalence was 0.47%, affecting approximately 247,000 individuals. HIV disproportionately affects young people, creating significant social, medical, & economic challenges. It ranks eighth in low-income nations & 19th globally in terms of causes of mortality.[3] India's first HIV case

was identified in 1986 in Chennai.[4] NACP(National AIDS Control Programme) had been established in 1987 to combat epidemic, incorporating initiatives like HIV education, blood screening, & surveillance. Prevention of Parent-to-Child Transmission (PPTCT) initiative had been presented in 2002 with the goal of lowering mother-to-child transmission, which is main way that HIV is spread among children under the age of fifteen.[5] Autonomic nervous system (ANS) dysfunction is common in HIV-positive individuals, with prevalence rates between 0.0% and 84.0%, depending on various factors. Symptoms include presyncope, syncope, dry eyes or mouth, and gastrointestinal issues. Subclinical autonomic neuropathy affects up to 50% of HIV-positive individuals. The viral load directly correlates with rate of CD4 count decline. In India, HIV prevalence has declined from a peak of 0.38% in 2001-2003 to 0.26% in 2015. The overall prevalence is about 0.3%, higher than global average of 0.2%,

Windows version 23.0 of Statistical Package for Social Sciences (SPSS) had been used to evaluate all patient data. In quantitative data, arithmetic mean \pm standard deviation had been displayed. Frequencies or percentages were used to represent qualitative data. Categorical variables had been compared between two groups utilizing chi-square test. To evaluate intra-group variation & post hoc testing for variations across time, analysis of variance (ANOVA) was implemented. P-values <0.05 had been regarded as statistically significant.

Objectives

- Examine cardiac autonomic dysfunction in patients having recent HIV/AIDS diagnoses.
- Determine correlation between cardiac autonomic

dysfunction & CD4 count levels.

Methodology

This Cross-sectional study was conducted on 95 newly diagnosed HIV AIDS patients at Medicine Department, Sarojini Naidu Medical College, Agra after receiving ethical approval from institute, over a period of 18 months, from January 2023 to June 2024.

Inclusion Criteria

1. Age >or=18yrs
2. Consent will be acquired in writing.
3. Every newly diagnosed HIV patient enrolled in our ART facility

Exclusion criteria

1. Age less than 18 years
2. Not giving consent
3. Patients with diabetes mellitus, uremia, & severe anaemia
4. Extremely sick patients
5. Individuals with a history of both ongoing & past alcohol misuse.
6. Patients with known cardiovascular diseases.

Patient's written informed permission was obtained following institutional ethics committee approval & clearance from BMCRI. Each patient's demographic profile, investigations, clinical assessment, & data collection were conducted utilizing a study proforma. Using a standard ECG, QT dispersion was measured and calculated by deducting difference between minimum QT interval (QT min) & highest QT interval (QT max).

Following maneuvers (The autonomic function tests' Ewing battery) were carried out.

- Response to HR after getting out of a recumbent position.

- Changes in HR in response to deep breathing.
- Response of Valsalva manoeuvre's HR.
- Standing's impact on SBP.

Response of DBP to sustained handgrip.

Observations and Results

Table 1: Distribution of cases according to Heart Rate {HR} response to standing and Valsalva ratio

		Frequency (n=95)	Percentage
Lying-to-standing HR response	Normal	67	70.5%
	Borderline	23	24.2%
	Abnormal	5	5.3%
HR Variation to Valsalva (ratio)	Normal	44	46.3%
	Abnormal	51	53.7%

Graph 1: Distribution of cases according to Heart Rate response to standing and Valsalva ratio

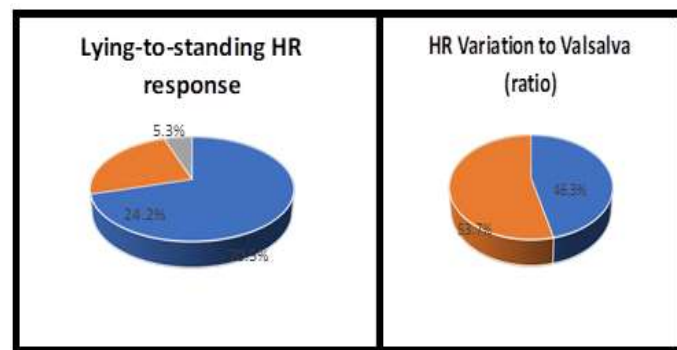


Table 2: Distribution of cases according to Heart Rate response to Deep Breathing and Systolic BP response

		Frequency (n=95)	Percentage
Heart rate response to deep breathing	Normal	61	64.2%
	Borderline	9	9.5%
	Abnormal	25	26.3%
SBP response to standing	Normal	48	50.5%
	Borderline	44	46.3%
	Abnormal	3	3.2%

Graph 2: Distribution of cases according to Heart Rate response to deep breathing and Systolic BP response

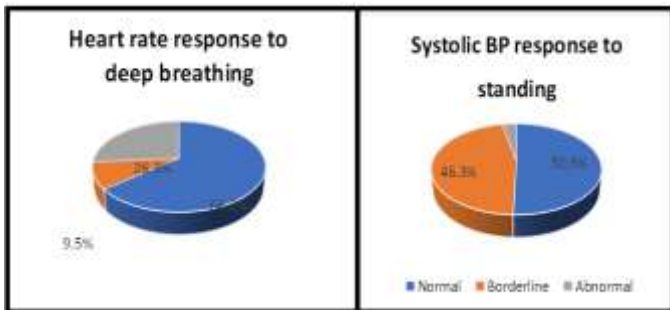


Table 3: Distribution of cases according to Diastolic BP response to sustained hand grip

Increase in Diastolic BP	Frequency (n=95)	Percentage
Normal	45	47.4%
Borderline	17	17.9%
Abnormal	33	34.7%

Graph 3: Distribution of cases according to Diastolic BP response to sustained hand grip

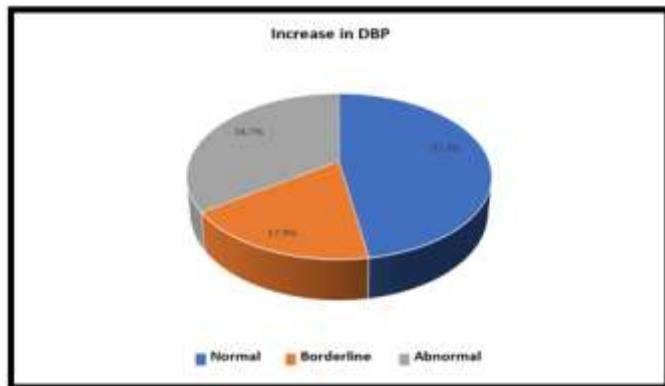
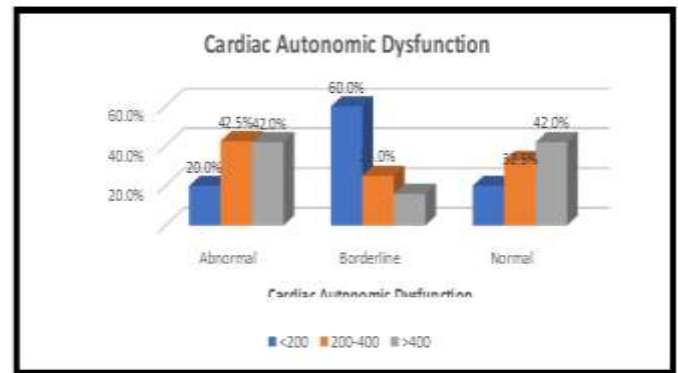


Table 4: Tabulation of correlation of CD4 count with cardiac autonomic dysfunction

Cardiac Autonomic Dysfunction	CD4 cell count (cells/microL)			χ^2	p-value
	<200	200-400	>400		
Abnormal	1 (20.0)	17 (42.5)	21(42.0)	5.765	0.217
Borderline	3 (60.0)	10 (25.0)	8 (16.0)		

Normal	1(20.0)	13(32.5)	21(42.0)		
Total	5 (100.0)	40 (100.0)	50 (100.0)		

Graph 4: Tabulation of correlation of CD4 count with cardiac autonomic dysfunction



- The study retrospectively analysed 95 patients based on age, typology, gender, CD4 count, heart rate(HR) response, & QT dispersion.
- Patients between ages of 20 & 30 made up largest percentage (51.6%), followed by those between ages of 31 & 40(29.5%).
- Patients aged 41-50 & over 50 years constituted smaller groups(12.6% & 6.3%,respectively).
- Males represented 72.7% of sample, while females accounted for 27.3%.
- Heterosexuals were most common typology (38.9%), followed by MSM (24.2%) & FSW (18.9%).
- Smaller groups included truckers & IDUs (3.2%each), with some patients having unknown typologies (7.4%).
- Regarding CD4 counts, no patients had counted in 0-50 or 51-100 cells/microL ranges.
- The most frequent CD4 count range was 301-400 cells/microL (22.1%), followed by 201-300 & 501-600 cells/microL (20.0% & 22.1%, respectively).

- HR response analysis revealed that 70.5% of patients had a normal lying-to-standing HR response, with 24.2% borderline & 5.3% abnormal responses. (Table 1) (Figure 1)
- HR variation to Valsalva manoeuvre showed 46.3% normal & 53.7% abnormal ratios. (Table1)(Figure1)
- 26.3% of patients showed an aberrant HR response to deep breathing, compared to 64.2% who had a normal response. (Table2)(Figure2)
- 50.5% of patients were having a normal systolic BP response to standing, 46.3% had a borderline response, & 3.2% had an abnormal reaction.
- 47.4% of patients a normal diastolic BP response to prolonged hand grip, 17.9% had a borderline reaction, & 34.7% had an abnormal response. 76.8% of patients had a resting heart rate of <100 bpm. (Table3)(Figure3)
- Cardiac autonomic dysfunction was normal in 41.1% of patients, borderline in 22.1%, & abnormal in 36.8%.
- QT dispersion was normal in 62.1% of patients & abnormal in 37.9%, with no significant correlation found between QT dispersion & CD4 count. (Table4)(Figure4).

Discussion

We aimed to study the assessment of cardiac autonomic dysfunction in relationships between newly diagnosed HIV/AIDS patients & their CD4 count. In present study, majority of studied cases were in age ranging from 20 to 30 years (51.6%) followed by 31 to 40 years (29.5%) with mean age 38.32 ± 12.4 years & male predominance (72.7%). Our conclusions have been comparable to findings of **Kumar K et al**[1].

In current investigation, Heterosexuals were most common typology (38.9%), followed by MSM (24.2%)

& FSW (18.9%) which is consistent with **Bishnu S et al**[6].

In current study, most common CD4 count range was 301-400 cells/microL, with 21 patients, accounting for 22.1% of total sample. Similarly, ranges of 201-300 cells/microL & 501-600 cells/microL each had 19 patients, contributing 20.0% & 22.1% respectively. CD4 counts between 401-500 cells/microL were observed in 18 patients, representing 18.9% of sample, while counts greater than 600 cells/microL were found in 11 patients, comprising 11.6% of sample. Our findings were congruent with results of **Abdollah A et al**[7]

This study, for lying-to-standing heart rate (HR) response, the majority of patients, 67 individuals (70.5%), exhibited a normal response, while 23 patients (24.2%) showed a borderline response, and 5 patients (5.3%) had an abnormal response. Regarding HR variation to the Valsalva manoeuvre, 44 patients (46.3%) had a normal ratio, whereas 51 patients (53.7%) showed an abnormal ratio. Our findings were supported by **Kumar K et al** [1]

Regarding influence of HR to deep breathing, most patients, 61 individuals (64.2%), exhibited a normal response, while 9 patients (9.5%) showed a borderline response, & 25 patients (26.3%) had an abnormal response. Regarding SBP response to standing, 48 patients (50.5%) had a normal response, 44 patients (46.3%) showed a borderline response, & 3 patients (3.2%) had an abnormal response. Our findings were comparable to results of **Kumar K et al**[1] & **Mahesh M et al**[8]

In current study majority of patients, 45 individuals (47.4%), exhibited a normal DBP rises as a result of prolonged hand grip. Borderline responses were observed in 17 patients (17.9%), while 33 patients

(34.7%) showed an abnormal increase in diastolic blood pressure (DBP). **Kumar K et al [1] & Nzuobontane D et al [9]**

In our research, most patients, 73 individuals (76.8%), had a resting heart rate <100 beats per minute(bpm). Conversely, 22 patients (23.2%) have a resting heart rate of 100 bpm or higher. Comparable results were reported by **Kumar K et al[1] & Badiger S et al[10]**

Among HIV-positive patients, 59 individuals (62.1%) exhibited a normal QT dispersion, while 36 patients (37.9%) showed an abnormal QT dispersion. The distribution of QT dispersion (normal vs. abnormal) across different CD4 count ranges (<200,200-400,>400cells/microL). Among patients with normal QT dispersion, 2 had a CD4 count <200, Thirty-one had a CD4 count greater than 400, & twenty-six had a value between 200 & 400. Three had a CD4 count <200, fourteen had a CD4 count between 200 & 400, significant correlation between QT dispersion & CD4 count in studied population, indicating that CD4 count may not directly influence QT dispersion abnormalities in these patients($p>0.05$). Our findings were in concordance with result of **Kumar K et al[1] & Sahu UK et al [11]**.

Conclusion

HIV causes changes in autonomic nervous system function. There could be a correlation between rising HIV & rising autonomic dysfunction. In individuals with HIV, cardiac autonomic dysfunction has prevalent & clinically significant issue. A decrease in CD4 count & a rise in disease severity both exacerbate dysfunction. In individuals living with HIV, when cardiac autonomic dysfunction occurs, most common symptom is decreased heart rate variability. QT dispersion is a basic ECG measure that indicates aberrant ventricular repolarisation

& is predictive of cardiac autonomic dysfunction. QT dispersion is correlated with worsening of cardiac dysautonomia. Autonomic dysfunction can also be caused by certain antiretroviral medications. When HIV patients are newly diagnosed, early identification of cardiac autonomic dysfunction facilitates implementation of appropriate treatment strategies to reduce morbidity & death from cardiac events.

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