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Patterns of Arrythmias among HIV infected Patients on Highly Active Antiretroviral Therapy (HAART) and its Relationship with CD4 Cells Count and Viral load in a Tertiary Hospital in North Eastern Nigeria

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Abstract

Background: Human immunodeficiency virus (HIV) pandemic continues to be a major public health problem globally. The advent of highly active antiretroviral therapy has changed the natural history of HIV as well as the morbidity and mortality associated with the disease. However, patients living with HIV infection remain at increased risk of cardiovascular diseases and sudden cardiac death. Diverse electrocardiographic abnormalities were reported among HIV infected patients. However, to the best of our knowledge, there are few studies on patterns of arrhythmias among HIV infected patients in northeastern part of Nigeria.

Method: It was a cross-sectional study conducted among HIV infected patients receiving highly active anti-retroviral therapy (HAART) at the Federal Medical Centre Nguru, Yobe State, North Eastern Nigeria.

Result: One hundred (100) subjects were recruited into the study comprising thirty-three (33.0%) males and 67(67.0%) females. The mean CD4 cells count and viral load of the studied patients were 614.99 ± 34.92 cells/μL and 4654±58.79 copies/mL, respectively. The commonest cardiac rhythm was sinus rhythm, followed by sinus tachycardia and atrial fibrillation. Other abnormalities observed includes: First degree atrioventricular block, nonspecific intraventricular conduction defect, right bundle branch block, left bundle branch block and left posterior hemi block.

Conclusion: In conclusion, the study revealed that premature ventricular contractions both (unifocal and multifocal) are the commonest cardiac arrhythmias, while sinus tachycardia and non-specific intraventricular conduction defect are the second common cardiac arrhythmias, the study further revealed that low CD4 cells count and high viral load were found to be associated with diverse cardiac arrhythmias.

Keywords: Arrhythmia, HIV, Highly Active Antiretroviral Therapy, CD4 cells and viral load.

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Introduction

Human immunodeficiency virus (HIV) pandemic continues to be a major public health problem globally. Nigeria has a HIV prevalence of 2.1% among adults aged 15–49 years which corresponds to approximately two million people living with HIV, with Yobe state having the lowest prevalence of 0.4%.[1] The advent of highly active antiretroviral therapy has changed the natural history of HIV as well as the morbidity and mortality associated with the disease.[2] However, patients living with HIV infection remain at increased risk of cardiovascular diseases and sudden cardiac death.[3] Varying prevalence of electrocardiographic (ECG) abnormalities among HIV infected patients were reported: Attamah et al[4] reported the prevalence of electrocardiographic abnormalities among HIV infected patients as 34.5%, while Orunta et al[5] reported a prevalence of 42.9%, and Njoku et al[6] reported a prevalence of 93.0%. Diverse electrocardiographic abnormalities were reported among HIV infected patients, these includes: prolongation of QTc interval with torsades de pointes (TdP), nonspecific ST-T changes, nonspecific, left and right bundle branch block, left anterior hemi block, left posterior hemi block, intraventricular conduction defect, unifocal premature ventricular contractions, multifocal premature ventricular contractions, atrioventricular blocks, atrial fibrillation (AF), atrial flutter and none sustained ventricular tachycardia (VT) patients.[4-10] However, to the best of our knowledge, there are few studies on patterns of arrhythmias among HIV infected patients in northeastern part of Nigeria. Thus, the objective of this study was to determine the patterns of arrhythmias among HIV infected patients on highly active antiretroviral therapy and its relationship with CD4 cells count and viral load.

Method

The study was a cross-sectional conducted among HIV infected patients receiving highly active anti-retroviral therapy (HAART) at the Federal Medical Centre Nguru, Yobe State, North Eastern Nigeria. Ethical approval for the study was obtained from the Ethics and Research Committee of the Federal Medical Centre Nguru Yobe State, Nigeria (study reference number: FMC/N//CLSERV/355/VOL III/155 dated 11 January, 2022). All studied subjects signed an informed consent form after been fully explained before enrolment. As part of our exclusion criteria, hypertensive patients and patients with echocardiographic evidence of rheumatic heart disease were excluded from the study. Other patients excluded from the study include: patients with history of heart disease predating the diagnosis of HIV infection, patients with thyrotoxicosis, diabetes mellitus, obesity, obstructive sleep apnoea as well as patients with significant history of cigarette smoking and alcohol consumption. Patients were categorized into three groups based on CD4 cells count according to United State Centre for Disease Control (CDC) classification as follows: CD4 cell count <200 cells/μL, CD4 cell count 200–499 cells/μL and CD4 cells count ≥500 cells/μL,[11] and viral load according to World Health Organization (WHO)[12] as follows: Undetectable (<50 copies/mL), suppressed viral load (50-1000 copies/mL) and unsuppressed viral load (>1000 copies/mL)

After considering the exclusion criteria, consented adult (age ≥18 years) HIV infected patients were enrolled into the study using a consecutive sampling method. Information on socio-demographic and clinical characteristics of the patients were obtained from their respective clinical case notes. General physical examination including anthropometric measurements were carried out for all study subjects, their body mass indices (BMI) were calculated. All patients had full cardiovascular and respiratory system examinations, fasting blood glucose, fasting lipid profile, serum electrolytes, urea, creatinine, urinalysis and packed cell volume (PCV) done. CD4 cells count and viral load estimation were done using Cyflow laser product Patec GmbH Am plus Platz 13 D028282010 and Cobas Ampliprep Cobas tagman (48 samples per batch) model 395808 Ampliprep/4312 machines, respectively.

Electrocardiography was done by electrocardiographic technician using electrocardiogram machine model -12 Express (serial number SE122B0911291BF Shanghai international Holding Corp.GmbH (Europe). Edan Instrument, Inc. 3/F-B Nanshan medical equipment Park Nanhai). While the ECG interpretation was done by the first author.

Data Analysis

Statistical analysis was done using SPSS version 27.0 (IBM SPSS Statistics), data were presented as mean ± standard deviation (SD) for continuous variables, analysis of variant (Anova) was used to compare multiple means while categorical variables were expressed as frequencies and proportions. Fisher's exact tests was used to test for significance between categorical variables. Our Null hypothesis was that there is no difference in arrhythmia between patients with low and high CD4 cells count and viral load. A P value of < 0.05 was considered as significant.

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Results

Demographic and clinical characteristics of the studied population

One hundred (100) subjects were recruited into the study comprising thirty-three (33.0%) males and 67(67.0%) females. The mean age, body mass index (BMI) and duration of HIV treatment in years of the studied subjects were 37.12±9.60, 22.03±1.88 and 5.38±2.17, respectively. The mean systolic and diastolic blood pressure of the subjects were 126.70±10.15 and 81.80±7.16 respectively.

Laboratory findings among the studied Population

One patient (1.0%) had HIV/Hepatitis B virus (HBV) co-infection and none had Hepatitis C virus (HCV) co-infection. The mean packed cell volume (PCV) and estimated glomerular filtration rate (eGFR) of the studied patients were 31.03±5.86 % and 77.89±3.31mls/min respectively. The mean CD4 cells count and viral load of the studied patients were 614.99 ± 34.92 cells/μL and 4653±58.79 copies/ml, respectively. Other laboratory results of the studied patients showed that the mean serum sodium, potassium, chloride, bicarbonate, fasting blood glucose and fasting lipids profile were all within normal limit. However, analysis of variance (Anova) of mean values of sodium, urea, creatinine and fasting cholesterol across the CD4 cells count groups showed a significant difference. However, on post hoc analysis, significant difference in serum sodium, urea and creatinine across the CD4 cells group was only observed between CD4 cells group <200 cells/μL and >500 cells/μL (P = 0.008, < 0.001 and < 0.001) respectively. Similarly, significant differences were also observed in mean values of sodium, urea, creatinine and fasting total cholesterol across the different groups of viral loads. Post hoc analysis of mean serum sodium, urea and creatinine revealed a significant difference only across viral load groups <50 copies/ml and >1000 copies/ml (P = 0.024, < 0.001, < 0.001) respectively. Table 1 showed the distribution of mean laboratory results according to CD4 cells count and viral load among the studied population.

Table 1: Mean laboratory results according to CD4 cells count and viral load among the studied population

Laboratory Results	Mean CD4 cells count (cells/μL)			P-value
	<200	200-499	≥ 500	
Sodium (mmol/L)	137.50±4.83	139.06±3.50	140.65±2.65	<0.001*
Potassium(mmol/L)	3.39±0.31	3.58±0.30	3.65±0.36	0.166
Chloride(mmol/L)	107.91±4.48	106.06±4.09	104.56±3.29	0.350
Bicarbonate(mmol/L)	19.25±1.42	17.83±3.05	25.68±2.72	0.287
Urea(mmol/L)	9.86±1.86	8.30±2.94	4.75±1.84	0.002*
Creatinine(μmol/L)	152.58±34.24	147.86±38.78	100.32±26.17	0.006*
FBG (mmol/L)	4.55±0.37	4.67±0.92	4.48±0.44	0.476
TC (mmol/L)	4.54±0.26	4.17±0.53	3.91±0.58	0.476
HDL cholesterol (mmol/L)	1.26±0.13	1.27±0.15	1.28±0.15	0.832
LDL Cholesterol (mmol/L)	2.39±0.31	2.40±0.51	2.16±0.49	0.128
Triglycerides (mmol/L)	2.01±0.43	2.17±0.38	1.95±0.45	0.171
	Mean viral load (copies/ml)			
	< 50	50 - 1000	≥1000	P-value
Sodium (mmol/L)	140.76±3.19	140.67±2.54	138.78±3.81	0.017*
Potassium(mmol/L)	3.54±0.34	3.66±0.36	3.56±0.33	0.360
Chloride(mmol/L)	104.53±3.40	104.87±3.25	106.12±4.32	0.214
Bicarbonate(mmol/L)	24.23±3.74	21.55±3.3.58	22.95±3.70	0.911
Urea(mmol/L)	3.92±0.99	5.02±2.07	8.32±2.89	< 0.001*
Creatinine(μmol/L)	91.76±24.43	102.35±26.84	144.66±38.27	< 0.001*
FBG (mmol/L)	4.64±0.58	4.43±0.41	4.61±0.76	0.317
TC (mmol/L)	3.78±0.82	3.92±0.48	4.26±0.50	0.003*
HDL cholesterol (mmol/L)	1.31±0.17	1.27±0.14	1.27±0.13	0.613
LDL Cholesterol (mmol/L)	2.14±0.64	2.19±0.45	2.35±0.47	0.195
Triglyceride (mmol/L)	1.73±0.50	2.04±0.42	2.09±0.41	0.032*

FBG = Fasting Blood Glucose, PCV = Packed Cell Volume, TC = Total Cholesterol, LDL Low Density Lipoprotein, HDL = High Density Lipoprotein, CD4 = Cluster of Differentiation, , * = Significant at Fisher Exact P = value < 0.05

All the patients with CD4 cells count < 200 cells/μL had anaemia while only one out of the 58 (1.7%) patients with CD4 cells count > 500cells/μL had anaemia. Similarly, 28(48.3%) and 27(46.6%) patients with CD4

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cells count ≥500 had eGFR > 90mls/Hr, and 60-90mls/Hr respectively. On the other hand, low eGFR was observed among patients with low CD4 cells count. All the 13(100.0%) patients with undetectable viral load had no anaemia, while 33(70.2%) out of 47 patients with viral load ≥ 1000 had anaemia. Similarly, 10(76.9%) out of the 13 patients with undetectable viral load had eGFR >90mls/Hr. Table 2 showed the distribution of anaemia and eGFR according to CD4 cells count and viral load among the studied patients.

Table 2: Anaemia and eGFR distribution according to CD4 cells count and viral load among the studied patients

Parameters	CD4 cells count/µL < 200 (N=12)	CD4 cells count/µL 200-499 (N= 30)	CD4 cells count/µL ≥ 500 (N=58)	P-Value
Anaemia				
Anaemia present	12(100.0%)	21(70.0%)	1(1.7%)	
No Anaemia	0 (0.0%)	9(30.0%)	1(1.7%)	< 0.001*
eGFR				
eGFR >90mls/Hr	0(0.0%)	3(10.0%)	28(48.3%)	
eGFR 60-90mls/Hr	1(8.3%)	6(20.0%)	28(48.3%)	
eGFR 30-59mls/Hr	7(58.3%)	12(40.0%)	2(3.4%)	
eGFR15-29mls/Hr	4(33.3%)	9(30.0%)	1(1.7%)	< 0.001*
	Viral load (copies/ml) < 50 (N=13)	**Viral load (copies/ml) 50-1000 (N= 40)**	**Viral load (copies/ml) ≥1000 (N=47)**	
Anaemia				
Anaemia present	0(0.0%)	1(2.5%)	33(70.2%)	
No Anaemia	13(100.0%)	39(97.5%)	14(29.8%)	< 0.001*
eGFR				
eGFR >90mls/Hr	10(76.9%)	15(37.5%)	6(12.8%)	
eGFR 60-90mls/Hr	3(23.1%)	22(55.0%)	9(19.1%)	
eGFR 30-59mls/Hr	0(0.0%)	2(5.0%	19(40.4%)	
eGFR15-29mls/Hr	0(0.0%)	1(2.5%)	13(27.7%)	< 0.001*

eGFR = Estimated Glomerular Filtration Rate, * = Significant at Fisher Exact P-value <0.05

Twelve (12.0%) patients had CD4 cells count of < 200 cells/µL, 30(30.0%) patients had CD4 cells count range between 200-499 cells/µL, 58(58.0.%) patients had CD4 cells count ≥500 cells/µL. On the other hand, 13(13.0%) patients had undetectable viral load (<50copies/ml), 40(40.0%) patients had a viral load range between 50-1000 copies/ml and 47(47.0%) patients had a viral load >1000 copies/ml. Tables 3 showed the distribution of CD4 cells count and viral load according to CDC and WHO classification among the studied patients.

Table 3: CD4 cells count and viral load distribution according to CDC and WHO classifications respectively indicating HIV disease severity among the studied patients

CD4 cells count classification	Frequency (%)
Severe < 200 cells/µL	12(12.0%)
Moderate 200-499 cells/µL	30(30.0%)
Mild ≥ 500cells/µL	58(58.0%)
Viral load classification	
Undetectable (<50 copies/ml)	13(13.0%)
Suppressed 50-1000 copies/ml	40(40.0%)
Unsuppressed >1000 copies/ml	47(47.0%)

CDC= Centre for Disease Control, WHO = World Health Organisation

Electrocardiographic findings of the studied population

Sinus rhythm was observed among 68(68.0%) patients, 30(30.0%) patients had premature ventricular contraction (PVCs), 16(16.0%) had unifocal PVC while 14(14.0%) had multifocal PVC. Twenty-seven (27.0%) patients had sinus tachycardia, 5(5.0%) had atrial fibrillation and none had atrial flutter. Non-specific intraventricular conduction defect (NSIVCD) was seen in 27 (27.0%) patients, while prolonged corrected QT-interval (QTc) was observed in 18(18.0%) patients. Six 6(6.0%) patients had first degree atrioventricular block, 7(7.0%) had right bundle branch block, 3(3.0%) had left bundle branch block, 11(11.0%) had left posterior hemi block and 9(9.0%) had left anterior hemi block. Eight (8.0%) patients had ST segment depression, while the remaining 92(92.0%) had normal ST segment. T-wave abnormalities in form of T-wave inversion and flattened

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T-wave were seen in 15 (15.0%) and 6(6.0%) respectively. There was a statistically significant difference in these ECG findings between patients with low and high CD4 cells count. Most of the ECG abnormalities were found among patients with low CD4 cells count. Table 4 showed the ECG findings according to CD4 cells count.

Table 4: Electrocardiographic findings according to CD4 cells count

CD4 cells count cells/μL	**<200 (N=12)**	**200-499 (N=30)**	**≥ 500 (N=58)**	**P-value**
Rhythm				
Sinus rhythm	1(8.3%)	9(30.0%)	58(100.0%)	
Sinus Tachycardia	6(50.0%)	21(70.0%)	0(0.0%)	
Atrial Fibrillation	5(41.7%)	0(0.0%)	0(0.0%)	
Atrial flutter	0(0.0%)	0(0.0%)	0(0.0%)	< 0.01*
A-V Block				
No A-V block	6(50.0%)	30(100.0%)	58(100.0%)	
1st degree A-V block	6(50.0%)	0(0.0%)	0(0.0%)	
2nd degree A-V block	0(0.0%)	0(0.0%)	0(0.0%)	
3rd degree A-V block	0(0.0%)	0(0.0%)	0(0.0%)	
NSIVCD				
NSIVCD present	12(100.0%)	15(50.0%)	0(0.0%)	
NSIVCD absent	0(0.0%)	15(50.0%)	58(100.0%)	< 0.01*
BBB				
No BBB	1(8.3%)	11(36.7%)	58(100.0%)	
LBBB	0(0.0%)	3(10.0%)	0(0.0%)	
RBBB	2(16.7%)	5(16.7%)	0(0.0%)	
LPH	5(41.7%)	6(20.0%)	0(0.0%)	
LAH	4(33.3%)	5(16.7%)	0(0.0%)	< 0.01*
PVCs				
No PVCs	0(0.0%)	12(40.0%)	58(100.0%)	
Unifocal PVCs	6(50.0%)	10(33.3%)	0(0.0%)	
Multifocal PVCs	6(50.0%)	8(26.7%)	0(0.0%)	< 0.01*
QTc				
Prolonged QTc	12(100.0%)	6(20.0%)	0(0.0%)	
Normal QTc	0(0.0%)	24(80.0%0	58(100.0%)	< 0.01*
ST-Segment				
Normal ST-segment	9(75.0%)	25(83.3%)	58(100.0%)	
ST-segment elevation	0(0.0%)	0(0.0%)	0(0.0%)	
S- segment depression	3(25.0%)	5(16.7%)	0(0.0%)	< 0.01*
T-Wave				
Normal T-wave	5(41.7%)	16(53.3%)	58(100.0%)	
Flattened T-wave	1(8.3%)	5(16.7%)	0(0.0%)	
Inverted T-wave	6(50.0%)	9(30.0%)	0(0.0%)	< 0.01*

A-V= Atrioventricular, NSIVCD = Nonspecific intraventricular conduction defect, BBB = Bundle branch block, LBBB = Left bundle branch block, RBBB = Right bundle branch block, LPH = Left posterior hemiblock, LAH= Left anterior hemiblock, OTc = Corrected QT intervals, PVCs = Premature ventricular contractions, LAD = Left axis deviation, RAD = Right axis deviation, * = Significant at Fisher Exact P = value < 0.0

Similarly, the results also revealed that majority of the patients with high viral load had one ECG abnormality or the other while those with low viral load had normal ECG and the differences were found to be significant across the viral load groups. Table 5 showed the electrocardiographic findings according to viral load distribution.

Table 5: Electrocardiographic findings according to viral load distribution

Variables	**Viral load (copies/ml)**			**P-value**
	< 50 (N=13)	**50-1000 (N=40)**	**≥ 1000 (N=47)**	
Rhythm				
Sinus rhythm	13(100.0%)	40(100.0%)	15(31.9%)	

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Variables	Viral load (copies/ml)			P-value
	< 50 (N=13)	50-1000 (N=40)	≥ 1000 (N=47)	
Sinus Tachycardia	0(0.0%)	0(0.0%)	27(57.4)	
Atrial Fibrillation	0(0.0%)	0(0.0%)	5(10.6%)	
Atrial flutter	0(0.0%)	0(0.0%)	0(0.0%)	< 0.01*
A-V Block				
No A-V block	13(100.0%)	40(100.0%)	41(87.2%)	
1st degree A-V block	0(0.0%)	0(0.0%)	6(12.8%)	
2nd degree A-V block	0(0.0%)	0(0.0%)	0(0.0%)	
3rd degree A-V block	0(0.0%)	0(0.0%)	0(0.0%)	
NSIVCD				
NSIVCD present	0(0.0%)	0(0.0%)	27(57.4%)	
NSIVCD absent	13(100.0%)	44(100.0%)	20(42.6%)	< 0.01*
BBB				
No BBB	13(100.0%)	44(100.0%)	17(36.2)	
LBBB	0(0.0%)	0(0.0%)	3(6.4%)	
RBBB	0(0.0%)	0(0.0%)	7(14.9%)	
LPH	0(0.0%)	0(0.0%)	11(23.4%)	
LAH	0(0.0%)	0(0.0%)	9(19.1%)	< 0.01*
PVCs				
No PVCs	13(100.0%)	43(100.0%)	19(38.0%)	
Unifocal PVCs	0(0.0%)	0(0.0%)	17(34.0%)	
Multifocal PVCs	0(0.0%)	0(0.0%)	14(28.0%)	< 0.01*
QTc				
Prolonged QTc	0(0.0%)	0(0.0%)	18(38.3%)	
Normal QTc	13(100.0%)	43(100.0%)	29(61.7%)	< 0.01*
ST-Segment				
Normal ST segment	13(100.0%)	43(100.0%)	39(83.0%)	
ST segment elevation	0(0.0%)	0(0.0%)	0(0.0%)	
ST segment depression				
T-Wave				
Normal T-wave	13(100.0%)	43(100.0%)	26(55.3%)	
Flattened T-wave	0(0.0%)	0(0.0%)	6(12.8%)	
Inverted T-wave	0(0.0%)	0(0.0%)	15(31.9%)	< 0.01*

A-V= Atrioventricular, NSIVCD = Nonspecific intraventricular conduction defect, BBB = Bundle branch block, LBBB = Left bundle branch block, RBBB = Right bundle branch block, LPH = Left posterior hemiblock, LAH= Left anterior hemiblock, OTc = Corrected QT intervals, PVCs = Premature ventricular contractions, LAD = Left axis deviation, RAD = Right axis deviation, * = Significant at Fisher Exact P = value < 0.05

Discussion

Cardiovascular manifestation of HIV has long been described in several studies in the past, these include: pericarditis, myocarditis, cardiomyopathies, pulmonary hypertension, coronary artery disease and pulmonary vascular diseases.[3-6] A substantial proportion of subjects in this study were young patients in their productive age group with female subjects constituted a relatively higher proportion of patients. This finding is similar to what was reported by Amobi *et al* in a Bayesian predictive modelling study on estimation of HIV prevalence and burden in Nigeria.[1] The study also revealed a significant difference in mean serum sodium, urea and creatinine across the different groups of CD4 cells count and viral loads. However further analysis revealed that the significant difference existed only between group with mild and severe HIV disease. These findings could be due to several factors *viz*: Electrolytes derangements from recurrent diarrhea and vomiting associated with opportunistic infections, HIV associated nephropathy as well as syndrome of inappropriate antidiuretic hormone secretion (SIADHS) as earlier reported by other researchers.[13,14] Anaemia was mainly observed among patients with lower CD4 cells count and on the other hand, none of the patients with CD4 cells count > 1000 cells/μL had anaemia. Similarly, the distribution of eGFR according to CD4 cells count revealed that patients with lower CD4 cells count had significantly lower eGFR compared to those with higher CD4 cells count. Similarly, the proportion of patients with anaemia had significantly higher viral load compared to those without anaemia. Patients with lower eGFR were found to have significantly higher viral load and vice versa. These findings are in tandem with earlier studies which

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revealed that patients with severe HIV disease are at increased risk of renal decrease and anaemia.[14, 15]

This study revealed that premature ventricular contractions (PVCs) both (unifocal and multifocal) were the commonest cardiac arrhythmia, multifocal PVC was observed mainly among patients with severe HIV disease. While the second most common cardiac arrhythmia were sinus tachycardia and non-specific intraventricular conduction defect (NSIVCD). Prolonged corrected interval (QTc) was the third common cardiac arrhythmia however atrial fibrillation was found to be less common. Other electrocardiographic findings in includes: left posterior hemi block, left anterior hemi blocks, right bundle branch block, first degree atrio-ventricular block (A-V block) and left bundle branch block. These ECG abnormalities were mainly observed among patients with low CD4 cells count and high viral load. This therefore suggest that HIV disease severity is associated with diverse cardiac arrhythmias similar to what was previously reported by other researchers.[4-10,16] The pathophysiologic mechanisms linking HIV infection and these electrocardiographic abnormalities could be attributed to electrolyte derangement, myocarditis and pulmonary hypertension associated with advanced HIV disease.[13, 17-19]

Implications of the findings of this study

From this study therefore, it can deduce that HIV patients with severe disease (low CD4 cells count and high viral load) should be evaluated for arrhythmias to prevent the onset of life-threatening cardiac arrhythmias.

Limitations of the Study

The study was a cross-sectional and thus no follow up of patients to determine if immune restoration and virologic suppression following adequate treatment can reverse these electrocardiographic findings. Secondly, the study had no control subjects to compare the ECG findings between the cases and controls, thirdly the effect of HAART on some of the ECG i.e. QTc interval prolongation cannot be completely rule out as patients were enrolled while they were already on treatment. Lastly our subjects were only one hundred (100) therefore, there is need to have a large multi centred prospective study to elucidate further the relationship between ECG abnormalities with viral load and CD4 cells count.

Conclusion

In conclusion, the study revealed that premature ventricular contractions both (unifocal and multifocal) are the commonest cardiac arrhythmias, while sinus tachycardia and non-specific intraventricular conduction defect are the second common cardiac arrhythmias, the study further revealed that low CD4 cells count and high viral load were found to be associated with diverse cardiac arrhythmias.

Declarations

Authors' Contribution: Musa Mohammed Baba (designing the topic, data collection, interpretation of the electrocardiograph, review of literature, data analysis and report writing), Habu Abdul (data collection, review of literature, data analysis and discussion), Yekeen Ayodele Ayoola (review of literature and data analysis), Baba Waru Goni (review of literature and data analysis), Fatime Garba Mairari (data collection). All authors reviewed and approved the final version of the manuscript.

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