

Prevalence and risk factors of hypertension in HIV-positive adults on antiretroviral therapy in Ondo State, Nigeria

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Abstract

Introduction: The occurrence of hypertension in people living with human immunodeficiency virus/acquired immunodeficiency syndrome (PLWHA) on antiretroviral therapy (ART) is increasing. In Nigeria, where the national human immunodeficiency virus (HIV) prevalence is 1.4%, an estimated 700,000 PLWHA are on ART. We investigated the prevalence of hypertension and associated factors among adults on ART in Owo, Ondo State.

Material and methods: A retrospective study with 300 PLWHA on ART in Federal Medical Centre, Owo, was conducted. Hypertension was defined as systolic blood pressure (SBP) \geq 140 mm Hg and/or diastolic blood pressure (DBP) \geq 90 mm Hg. Descriptive statistics were performed. Chi-square tests were used to identify associations between sociodemographic/clinical parameters and hypertension. Odds ratio and adjusted odds ratio were used to examine risk factors associated with hypertension.

Results: The mean age of PLWHA was 38.3 years (SD, 10.4) and 33.7% were males. Median duration on ART was 6 years (range, 0.5-15). The prevalence of hypertension was 20.3%, with 25.7% in males and 17.5% among females. The prevalence of hypertension before commencing ART was 14.7% and 20.3% after ART was commenced ($p = 0.043$). Mean SBP was 110 ± 16 mm Hg before ART use and 118 ± 18 after utilization of ART ($p < 0.001$). Hypertension before commencing ART was associated with age of 38 years and above (OR: 2.7; 95% CI: 1.3-6.8). Amongst PLWHA, hypertension after commencing treatment was associated with being previously hypertensive (AOR: 9.2; 95% CI: 4.5-18.6).

Conclusions: HIV treatment programs should include screening and management of hypertension. Screening and assessment of risk factors were directed at PLWHA diagnosed with hypertension before commencing ART, while routine check of blood pressure was evaluated at subsequent visits.

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Key words: HIV, anti-retroviral therapy, PLWHA, hypertension among PLWHA.

Introduction

Antiretroviral therapy (ART) was a breakthrough in the management of people living with human immunodeficiency virus/acquired immunodeficiency syndrome (PLWHA).

ART has led to the reduction of mortality and the improvement of quality of life among PLWHA [1, 2]. ART has helped to transform the disease into a chronic treatable condition. In low- and middle-income countries (LMICs), there was a 16-fold increase in the number of people living with human

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immunodeficiency virus (HIV) receiving ART between 2003 and 2010 [3]. As the subpopulation of PLWHA in LMICs gets older, other chronic diseases, which are already on the rise in the general population, are developing. Morbidity and mortality among PLWHA from non-communicable diseases (NCDs), such as heart disease, stroke, diabetes, renal disease, cancers, liver disease, and mental illness are of concern [4]. The increased morbidity due to NCDs may be attributed to extended life expectancies but may also be related to HIV and its treatment [5-7].

High blood pressure is the leading risk factor for cardiovascular diseases worldwide, and accounts for 7% of global disability-adjusted life years (DALYs) and nearly 10 million deaths per year [8]. Although there are effective medical therapies for the management of hypertension, only 58% of adult patients with hypertension in the United States have their blood pressure (BP) controlled [9]. In a Nigerian study involving patients at a secondary health facility in Oyo state, only 33.6% was reported to have controlled BP [10]. Poor adherence to antihypertensive medications is a major barrier to the maintenance of controlled blood pressure. Uncontrolled blood pressure, often from non-adherence to medication use, results in cases of sudden deaths, stroke, and other untoward sequelae [11]. The level of hypertension among PLWHA on ART specifically has received less attention. A previous study by Ilesanmi et al. estimated BP control among patients in an outpatient setting as only 33.6% [10].

Risk factors associated with hypertension in the sub-population of PLWHA warrants further study to identify areas of intervention and provide evidence-based recommendations, especially in LMICs settings. This study aimed to identify the risk factors associated with hypertension among PLWHA receiving ART in Ondo State, Nigeria.

Material and methods

Study setting

The study was carried out at the Federal Medical Centre (FMC), Owo, a tertiary hospital located in Owo Local Government Area of Ondo State, South-West Nigeria. Owo is located about 350 km from Lagos state and 50 km from Akure, the state capital. The FMC, Owo, is a 250 bedded hospital, with approximately 1,350 staff members, of which doctors and nurses constitute nearly 50%. It is the only tertiary hospital in Ondo state and serves as the referral center for the people in surrounding areas (Osun, Ekiti, Edo, and Kogi states).

The ART clinic of the FMC, Owo, was established in February 2006. The center offers comprehensive HIV/acquired immunodeficiency syndrome (AIDS) treatment and care. People registered in the ART center are usually individuals diagnosed after voluntary counselling and testing (VCT). Pregnant women also join the adult ART clinic after completing antenatal clinic, which implements interventions for prevention of mother to child transmission (PMTCT). The center provides ART-free services for persons with CD4 count < 350 cells/mm³. PLWHA are enrolled

in the programme irrespective of their eligibility to start ART. Those who were not eligible to start ART are routinely monitored and screened for further admissibility. Drugs for self-administered treatment are collected monthly or every two months. Since the centers' inception, an average of 20-25 new cases of PLWHA are seen each week. As of May 2016, the clinic had enrolled about 3,550 PLWHA, of whom 2,500 were on ART. ART, which was used in approximately 97% of patients was first-line treatment.

Study design

A retrospective longitudinal study was conducted by gathering available socio-demographics and clinical data of PLWHA receiving ART. The variable outcome was hypertension status before commencing medication and after the treatment.

Study population

The study population comprised of PLWHA on ART recruited to care between 2012-2016 at the Federal Medical Centre, Owo, Ondo state, Nigeria.

Inclusion criteria

PLWHA who were aged 18 and above at the time of ART initiation and who commenced ART between 2012-2016 at the FMC, Owo, were included.

Exclusion criteria

Records of PLWHA with missing information on any of the outcome or independent variables were removed from the analysis.

Sample size and sampling technique

All medical records of patients who met the inclusion criteria were considered. A total of 311 medical records were reviewed, with the ultimate analysis sample consisting of 300 PLWHA; 11 records with missing information were excluded.

Study instruments

A checklist was developed based on available variables in the care card including sex, age, height, weight, CD4 count, blood pressure measurements, time since ART initiation, clinical state, and marital status.

Data analyses

Data were analyzed using IBM SPSS Statistics version 21 [12]. Data were cleaned for inconsistencies before analysis. Descriptive statistics including frequencies and proportions were used to summarize the distribution of data. *T*-test was used to compare the means of clinical and laboratory characteristics of PLWHA before and after commencing ART,

while chi-square test was applied to assess association between sociodemographic characteristics and hypertensive status before and after commencing ART. Binary logistic regression was used to determine the risk factors for hypertension. Adjusted odds ratios (AORs), with their respective 95% confidence interval (95% CI) were estimated for the factors included in the model. Level of statistical significance was set at 5%. All results were presented with tables and charts.

Results

Socio-demographics of people living with HIV/AIDS

The records of 300 PLWHA on ART were reviewed for this study (Table 1). Of these, 33.7% were males ($n = 101$). As of their most recent visit to the clinic, the mean age of patients was 38.3 years (SD = 10.4) and 14.3% of patients were not living with their spouses. The mean duration of ART use at the time of the chart review was two and a half years (SD = 0.5).

Clinical characteristics of people living with HIV/AIDS

Of the PLWHA records reviewed, nearly half presented normal body mass index (47.3%), while 16% of patients were classified as obese at their most recent visit (Table 1). The majority of patients (71%) started ART at clinical stage one and were still at stage one (93.3%) during the study. In all, 14.7% of the PLWHA were hypertensive before they commenced HIV treatment and the prevalence of hypertension among patients on treatment was 20.3%. Among the 256 (85.3%) patients that were not hypertensive before commencing ART, 35 (13.7%) became hypertensive. More than half (77.8%) of the PLWHA had increased CD4 counts compared to the count before commencing ART, and about ninety-one percent (90.7%) were not on drug combination that included efavirenz during the review period.

Clinical characteristics of people living with HIV/AIDS before and after commencing antiretroviral therapy

Compared to body weight measurements before ART initiation (58.6 ± 12.3), weight tended to increase after ART commenced (66.0 ± 13.5). In general, BP increased in patients after they started ART, compared to before they started ART. The mean SBP was 110 ± 16 mm Hg before and 118 ± 18 after ART initiation ($p < 0.001$). Mean DPB was 69 ± 11 mm Hg before and 72 ± 12 after HIV treatment commenced ($p < 0.001$) (Table 2).

Blood pressure categories of people living with HIV/AIDS on antiretroviral therapy

Figure 1 demonstrates the differences in blood pressure categories among PLWHA on ART. Ninety were at the pre-

Table 1. Socio-demographic and clinical characteristics of people living with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome on antiretroviral therapy at Federal Medical Centre, Owo, between 2012 and 2016

Characteristics	Frequency	%
Age group in years		
< 38	156	52.0
≥ 38	144	48.0
Sex		
Male	101	33.7
Female	199	66.3
Currently living with spouse		
Yes	257	85.7
No	43	14.3
Present body mass index ($n = 131$)*		
Under weight	6	4.6
Normal	62	47.3
Overweight	42	32.1
Obese	21	16.0
Clinical stage of HIV at start of ART		
Stage 1	213	71.0
Stage 2	25	8.3
Stage 3	60	20.0
Stage 4	2	0.7
Clinical stage on ART (at present)		
Stage 1	280	93.3
Stage 2	9	3.0
Stage 3	8	2.7
Stage 4	3	1.0
Hypertensive before ART commenced		
No	256	85.3
Yes	44	14.7
Hypertensive now on ART		
No	239	79.7
Yes	61	20.3
CD4 increase (present compared to before starting ART)		
Yes	182	77.8
No	52	22.2
Efavirenz used		
Yes	28	9.3
No	272	90.7

*Height measurement was not available for all the PLWHA. ART – antiretroviral therapy

hypertensive stage, while sixty-one PLWHA were at the hypertension stage (stage 1, 49; stage 2, 12).

Table 2. Clinical characteristics of people living with human immunodeficiency virus/acquired immunodeficiency syndrome before and after starting antiretroviral therapy at the Federal Medical Centre, Owo, between 2012 and 2016

Variables	Before commencing ART (n = 300)	After commencing ART (n = 300)	p-value	Mean difference (95% confidence interval of the difference)
Systolic blood pressure (mm Hg)	110 ± 16	118 ± 18	< 0.001*	-8.80 (-10.9 to -6.77)
Diastolic blood pressure (mm Hg)	69 ± 11	72 ± 12	< 0.001*	-3.23 (-4.57 to -1.89)
Body weight (kg)	58.6 ± 12.3	66.0 ± 13.5	< 0.001*	-7.38 (-8.55 to -6.21)
Body mass index	21.4 ± 4.3	25.1 ± 5.1	< 0.001*	-3.62 (-4.33 to -2.9)
CD4**	260 (13-1,277)	470 (13-1,675)	< 0.001**	

*Paired t-test. **One-sample Kolmogorov-Smirnov test. ART – antiretroviral therapy

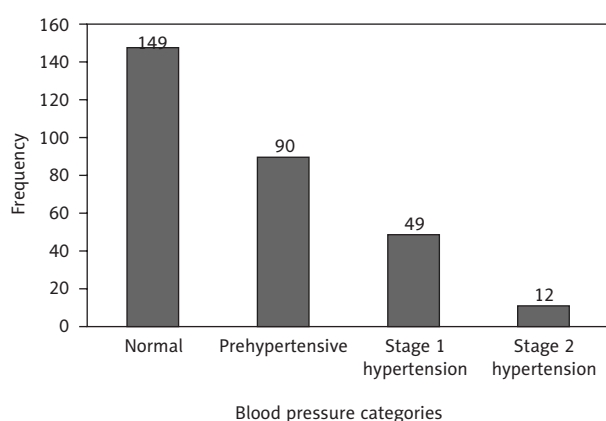


Figure 1. Blood pressure categories of patients on antiretroviral therapy

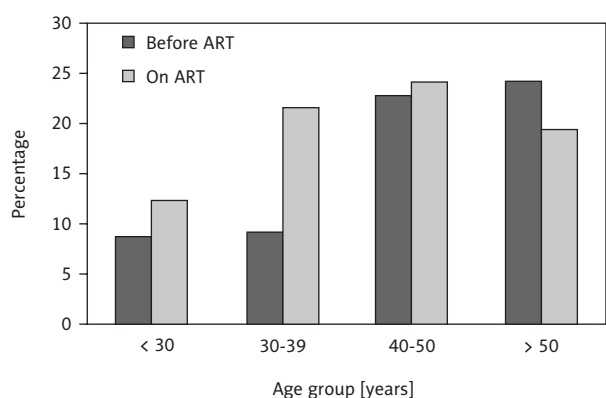


Figure 3. Prevalence of hypertension before and after commencing antiretroviral therapy at the Federal Medical Centre, Owo, between 2012 and 2016

Prevalence of hypertension amongst people living with HIV/AIDS on antiretroviral therapy

The prevalence of hypertension was 14.7% before and 20.3% after commencing ART. Prevalence estimates were

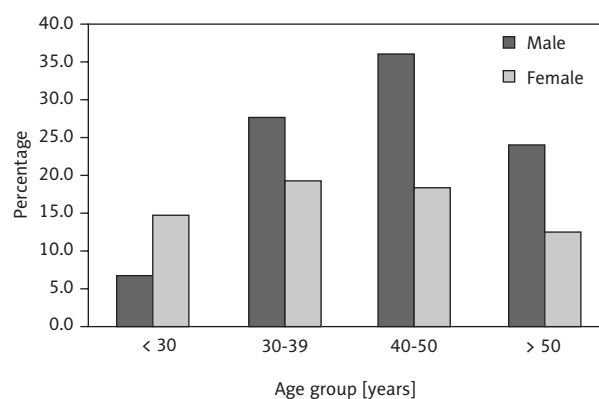


Figure 2. Prevalence of hypertension by sex in people living with human immunodeficiency virus/acquired immunodeficiency syndrome on antiretroviral therapy at the Federal Medical Centre, Owo, between 2012 and 2016

higher among males across age groups, except those who were less than 30 years old. Female PLWHA less than 30 years had higher hypertension prevalence with 14.6%. Overall, male respondents within 40-50 years old presented the highest hypertension prevalence (36%) (Figure 2).

An analysis shown in Figure 3 reveals the increase of hypertension prevalence across all age groups in PLWHA on ART, with an exception of those who were fifty years or older and recorded higher prevalence before the commencement of ART. PLWHA within the 40-50 age range presented the highest hypertension prevalence (24.3%).

Association of socio-demographic characteristics and hypertensive status before and after commencing antiretroviral therapy

Before commencing ART, among those < 38 years, 14 (9%) patients were hypertensive as compared to 30 (20.8%) of those 38 years and above ($p = 0.004$) (Table 3). Hypertension before commencing ART was associated with age of 38 years and above (OR: 2.7; 95% CI: 1.3-6.8).

Table 3. Association of socio-demographic characteristics and hypertensive status before commencing antiretroviral therapy (ART) at the Federal Medical Centre, Owo, between 2012 and 2016

Characteristics	Hypertensive before ART		χ^2	p-value
	Yes, n (%)	No, n (%)		
Age in years				
< 38	14 (9.0)	142 (91.0)	8.414	0.004
≥ 38	30 (20.8)	114 (79.2)		
Sex				
Male	18 (17.8)	83 (82.2)	1.211	0.271
Female	26 (13.1)	173 (86.9)		
Currently leaving with spouse				
Yes	36 (14.0)	221 (86.0)	0.622	0.430
No	3 (18.6)	35 (81.4)		
Body mass index before antiretroviral therapy				
< 25	17 (15.2)	95 (84.4)	0.034	0.853
≥ 25	3 (13.6)	19 (86.4)		

Table 4. Association of socio-demographic characteristics and hypertensive status after commencing antiretroviral therapy (ART) at the Federal Medical Centre, Owo, between 2012 and 2016

Characteristics	Hypertensive now on ART		χ^2	p-value
	Yes, n (%)	No, n (%)		
Age in years				
< 38	31 (19.9)	125 (80.1)	0.043	0.836
≥ 38	30 (20.8)	114 (79.2)		
Sex				
Male	26 (25.7)	75 (74.3)	2.750	0.097
Female	35 (17.6)	164 (82.4)		
Currently leaving with spouse				
Yes	47 (18.3)	210 (81.7)	4.631	0.031
No	14 (32.6)	29 (67.4)		
Hypertensive before ART				
Yes	26 (59.1)	18 (40.9)	47.815	< 0.001
No	35 (13.7)	221 (86.3)		
Body mass index				
Under/normal weight (< 25)	12 (17.6)	56 (82.4)	0.043	0.836
Overweight/obese (≥ 25)	12 (19.0)	51 (81.0)		
Duration on ART				
< 2 years	23 (21.7)	83 (78.3)	0.188	0.664
≥ 2 years	38 (19.6)	156 (80.4)		

More than half (59.1%) of the PLWHA who were hypertensive before ART initiation remained hypertensive after treatment commencement as compared to 13.7% of patients that became hypertensive after commencing ART ($p < 0.001$). Among those not currently living with their spouse, 32.6% of patients were hypertensive while on ART compared to 18.3% of those living with their spouse ($p = 0.031$) (Table 4).

Predictors of hypertension after commencing antiretroviral therapy

Multivariate analysis in Table 5 shows that being hypertensive before the commencement of ART was significantly associated with remaining hypertensive while on ART (AOR: 9.2; 95% CI: 4.5-18.6).

Table 5. Predictor of being hypertensive after commencing antiretroviral therapy (ART) at the Federal Medical Centre, Owo, between 2012 and 2016

Characteristics	Odds ratio	95% confidence interval for OR		p-value
		Lower	Upper	
Currently leaving with spouse	0.458	0.209	1.003	0.051
Not currently leaving with spouse	1			
Hypertensive before ART use	9.155	4.517	18.555	< 0.001
Hypertensive now	1			

Discussion

This study aimed to assess the prevalence of hypertension and its associated risk factors among PLWHA. Findings from this study revealed that the prevalence of hypertension among PLWHA before commencing ART was 14.7%, while the prevalence increased to 20.3% after ART initiation. Among those who were not hypertensive at the time of commencing ART, 13.7% of them developed hypertension. Having hypertension before ART was a significant independent predictor of having hypertension after ART, suggesting poor blood pressure management among individuals in this sub-population. Of note, hypertension among PLWHA on ART was predominant even for individuals under 38 years of age, while individuals with hypertension before ART tended to be older (over 38 years of age).

The presented estimation of prevalence from our study was similar to that reported by others among PLWHA [13, 14]. Also, our rate of prevalence was higher than 13.5% reported in Jerico *et al.* study in PLWHA [15]. However, other studies also reported higher prevalence. Okello *et al.* found that incident hypertension is common among PLWHA initiating ART in rural Uganda, with nominally higher rates than HIV-positive populations previously reported elsewhere [16-19].

Regarding BMI status, there was no significant difference in the prevalence of hypertension amongst obese and normal weight PLWHA after the commencement of ART in this study. This is in contrast to Ogunmola *et al.* and other investigators, who have reported a significant difference in blood pressure of PLWHA on ART based on their BMI [13, 20, 21]. The BMI status might be similar because PLWHA are more in contact with healthcare services; therefore, they are more likely to obtain nutrition-related advices for healthy living [22].

In addition, the analysis failed to show a precise relationship between the duration on ART and the prevalence of hypertension. The prevalence of hypertension was higher amongst PLWHA who were on ART for less than 2 years; however, this was not statistically significant. The failure of PLWHA to accept their status and comply with the treatment, which has been found to be common in the first two years of recruitment into care, could be responsible. During the first two years, a significant difference may not exist between those in care and those who are not. Seaberg *et al.* found the duration of ART to be a predictor of hypertension [17]. The same was found in other studies, suggesting that

ART predisposes the development of high blood pressure in PLWHA who were on treatment for a longer time [20].

Comparing age-specific prevalence of hypertension, the prevalence among PLWHA aged 38 years and above was higher (20.8%). This is supported by the findings of Carlos *et al.*, Dimala *et al.*, and comparable reports from European population [15, 16]. Interestingly, there was a similarity in the distribution of hypertension by age group according to HIV after the commencement of ART.

In this study, the prevalence of hypertension was higher in PLWHA after the commencement of ART compared to before the treatment commencement across all variables. However, this was found to be non-significant, in contrary to the findings of other studies that supported the fact that ART could be associated with hypertension in PLWHA [16, 20, 23]. This analysis concurred with other studies, which reported no significant difference in the prevalence of hypertension between PLWHA on ART and those not on ART [13].

We found that clinical characteristics before and after the commencement of ART were statistically significant in this study. Some authors have found differences in clinical characteristics of PLWHA that were ART naïve and those on ART, while others reported no statistically significant differences. A Cameroonian study found that among PLWHA, SBP/DBP, BMI, and CD4 count were significantly different after the commencement of ART [16]. Other studies reported higher prevalence of hypertension among PLWHA on ART supporting ART association with hypertension [18, 24-26]. Okello *et al.* observed male gender, advancing age, and high body mass index to be related to an increased risk of developing hypertension and coronary heart disease (CHD) in PLWHA [18, 26, 27]. Bergensen *et al.* compared the prevalence of hypertension in PLWHA not using ART, in those receiving ART, and in HIV-negative controls [23]. They reported no statistical differences across three groups, which is similar to our findings. Likewise, Ogunmola *et al.* observed no significant differences in the prevalence of hypertension, mean SBP, and mean DBP between HIV-negative, HIV-positive on ART, and HIV-positive ART naïve PLWHA [13]. Interestingly, ART exposure has been also associated with decreased odds of hypertension in a large South African population-based survey [14].

The risk of having hypertension in this study was predicted by prior hypertensive status before ART. Though not significant, the odds of being hypertensive was lower among PLWHA on ART, who were living with their spouses during

the review for this study. This reinforces the need to provide PLWHA on ART with appropriate continuum of care and support beyond facility level.

Potential explanations for these dissimilar results of our study could be due to differences in study design, methodologies, cut-off values for BP, and other environmental factors, such as physical activity, diet, and salt intake, which were not considered. We reiterate that routine monitoring of hypertension and other cardiovascular risk factors should be encouraged/continued for PLWHA on ART in Nigeria.

Conclusions

The prevalence of hypertension increased after PLWHA commenced ART. HIV treatment programs should include screening and management of hypertension. Specific interventions, such as screening and assessment of risk factors were directed at PLWHA diagnosed with hypertension before commencing ART, while routine check of blood pressure was evaluated at subsequent visits.

Limitation

Information about anti-hypertensive medication used by PLWHA on ART for hypertension was not available as we used secondary data for this analysis. The prevalence of hypertension might have been underestimated. However, this study contributed to the understanding of factors associated with hypertension in PLWHA.

Conflicts of interest

The authors declare no conflict of interest.

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