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The magnitude of undiagnosed hypertension and associated factors among HIV-positive patients attending antiretroviral therapy clinics of Butajira General Hospital, Gurage Zone, Southern Ethiopia

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Abstract

Objectives: The study aimed to assess the magnitude of undiagnosed hypertension, and its associated factors among adult HIV-positive patients receiving antiretroviral therapy at Butajira General Hospital, southern Ethiopia.

Methods: We applied an institutional-based cross-sectional study design at Butajira General Hospital from 1 May to 1 July 2021. We used a systematic random sampling technique to select the total number of participants. A structured interviewer-administered questionnaire was applied to collect the data (sociodemographic characteristics, clinical-related factors, and lifestyle-related factors from the study participants. Data were entered using Epi-data version 3.1 and analyzed by statistical package for social science version 25. We applied a multivariable logistic regression analysis model to identify variables significantly associated with hypertension.

Results: The study comprised 388 participants with 39 years (10.6 SD) as the mean age of the participants. Of the total participants, 235 (60.6%) were female. In this study the magnitude of undiagnosed hypertension among HIV-positive patients was 18.8% (95% CI: 14.7%–23.2%). Having comorbidity of diabetes mellitus (adjusted odds ratio = 5.29, 95% CI: 2.154, 12.99), habit of alcohol drinking (adjusted odds ratio = 2.909, 95% CI: 1.306, 6.481), duration of antiretroviral therapy ⩾ 5 years (adjusted odds ratio = 3.087, 95% CI: 1.558, 6.115), and age ⩾ 40 years (adjusted odds ratio = 2.642, 95% CI: 1.450, 4.813) were factors significantly associated with undiagnosed hypertension.

Conclusions and recommendations: The magnitude of undiagnosed hypertension among HIV-positive patients attending the antiretroviral therapy clinic of Butajira General Hospital is high. The findings of this study implied that HIV-positive patients attending antiretroviral therapy clinics should be monitored routinely for hypertension; especially participants aged ⩾40 years, highly active antiretroviral therapy duration ⩾5 years, having diabetes mellitus comorbidity need more attention. Primary healthcare integration is also vital to enhance the health of HIV-positive patients on antiretroviral therapy.

Keywords

Hypertension, antiretroviral therapy, Butajira Hospital, southern Ethiopia

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Introduction

Hypertension is a force exerted by circulating against the walls of the body's arteries whose systolic blood pressure (SBP) values are ≥ 130 mmHg and diastolic blood pressure (DBP) values ≥ 80 mmHg.[1] A World Health Organization (WHO) report projected that deaths due to non-communicable diseases (NCDs) would increased by 15% globally from the 2010 estimates in the next future decades.[2] The WHO report showed that nearly 34% of Ethiopia's population had died due to NCDs, and hypertension (HTN) was responsible for about 15%.[3] Around 1.28 billion adult people in the world were hypertensive, and two-thirds of them are from the middle- and low-income countries.[4]

The global prevalence of HTN among adult HIV-positive patients on antiretroviral therapy (ART) was 34.7%.[5] Africa also suffered from the double burden of communicable and NCDs.[6] In Ethiopia, HTN prevalence in the general population is about 19.6%, and a higher proportion is in the urban than the rural areas.[7] Prevalence of HTN among HIV-infected adult patients in ART clinics of Ethiopia ranges from 12.7%[8] in Jugal Hospital, Harar to 41.3%[9] in northwest Ethiopia.

Pieces of evidence suggest that HIV infection leads to chronic inflammation and early atherosclerosis due to a high number of C-reactive proteins among HIV/AIDS patients that are a marker of inflammation.[10,11] The use of ART drugs, particularly protease inhibitor-containing ART regimen causes hyperlipidemia that contributes to a high prevalence of HTN in HIV/AIDS patients.[11,12] ART initiation for HIV dramatically reduced AIDS-related mortality in the developed and developing countries.

However, chronic comorbidities play a significant role in morbidity and mortality in patients with ART; follow-up clinics for cardiovascular disease mortality rates more than doubled in people living with HIV.[13]

A study from India showed that harmful alcohol consumption, high salt intake, age (45- to 69-year age group), and obesity were factors associated with undiagnosed HTN.[14] Previous studies in Ethiopia and Nigeria showed that undiagnosed HTN was significantly associated with older age, married marital status, and obesity.[15,16] Similarly, factors like physical inactivity, tobacco use, harmful use of alcohol, ART interactions, and unhealthy diets such as high intake of fat, salt, and refined sugars were contributors to NCD among HIV-positive patients.[17] Studies identified several risk factors for the occurrence of HTN. Being a smoker, being stressed, physical inactivity, BMI > 25, older age, alcohol consumption, CD4 count < 500 cell/mL, duration of highly active antiretroviral therapy (HAART), and increased total cholesterol[8,9,18–20] were factors significantly associated with HTN among HIV-infected individuals.

Although HTN is a poor prognosis marker among HIV-positive patients, there is no routine assessment of blood pressure measurement and risk identification in the day-to-day clinical practice of the study setting. Although there a few studies on the burden of HTN among HIV-positive patients in Ethiopia,[8,9,20] there is no adequate scientific evidence on the magnitude as well as on the contributing factors of undiagnosed HTN among HIV/AIDS patients in Ethiopia, particularly in the study area.

A systematic review and meta-analysis done in sub-Saharan Africa among the general population showed that only 27% of individuals with HTN know their HTN status.[21] The above figure indicates that a large population in developing countries with HTN is left undiagnosed and untreated. Early diagnosis and treatment are vital for hypertension management for HIV-positive individuals. In Ethiopia, the design/plan of HTN intervention considers only the diagnosed/known hypertensive individuals that ignore the large population. Therefore, this study aimed to assess the magnitude of undiagnosed HTN and associated factors among adult HIV-positive patients receiving ART at Butajira General Hospital, southern Ethiopia.

Materials and methods

An institutional based cross-sectional study was conducted at Butajira General Hospital from 1 May to 1 July 2021. Butajira general hospital is one of the hospitals found in southern nation nationalities and people's regional (SNNPR) state of Ethiopia; Gurage zone and, Wolkite is the capital city of the Gurage, which is 155 km from Addis Ababa, the capital city of Ethiopia. Nearly 2.7 million people with 16 districts and 5 city administrations are found in the Gurage zone. A total of 2400 HIV/AIDS-positive adult patients have undergone ART follow-up treatment in Butajira General Hospital.

Study populations

HIV-positive adult patients receive ART with a follow-up in the ART clinic and are available during the data collection period.

Inclusion and exclusion criteria

We included patients whose age was ⩾18 years old. We also included patients who had ART follow-up for at least 6 months. We excluded HIV-positive pregnant women and HIV-positive patients who were previously diagnosed with HTN.

Sample size and sampling techniques

We computed the sample size of this study using the following assumptions: $z^{a/2} = 1.96$ at 95% CI level, the margin of error = 5%, p (population proportion) = 41.3% that was studied in northwest Ethiopia, and adding 10% nonresponse rate at $n = \frac{z_{\frac{a}{2}}^2 (p(q)}{d^2} = \frac{1.96^2 (0.413(1-0.587)}{0.05^2} = 368$, and adding

10% nonresponse rate final sample size = 405. We used a systematic random sampling technique to select the study participants. Of the adult patients attending ART clinics of Butajira General Hospital for HIV care services (2400), 405 were selected using a systematic random sampling technique. Sampling interval (kth) was determined by dividing the total HIV-positive patients of Butajira Hospital attending ART follow-up clinics. $k = \frac{N}{n} = k = \frac{2400}{405} = 6$. The first participant was selected using a lottery method among the first six HIV-positive patients attending ART follow-up. Then every sixth patient was enrolled for the study based on their entry sequence for ART follow-up.

Study variables

Dependent variable: undiagnosed HTN.

Independent variables

- Sociodemographic characteristics (age, sex, education, occupation, family size);
- Clinical-related factors (viral load, WHO stage, ART duration, ART adherence);
- Lifestyle-related factors (smoking, alcohol drinking, khat chewing, physical activity).

Operational definition

- Hypertension: a high blood pressure having an SBP > 130 mmHg or DPB > 80 mmHg on at least two occasions.
- Undiagnosed HTN: refers to hypertensive individuals but did not report having been told by a health professional that they have HTN.
- Adherence to ART: the current adherence status of adults to ART is recorded as poor when an adult takes <85% of the dose, fair when an adult takes 85%–94% of the dose, and good when an adult takes 95%, and above.
- Comorbid disease: a chronic disease with a confirmed diagnosis of other diseases than HIV infection.
- Opportunistic infection is the list of opportunistic diseases documented on national comprehensive HIV prevention, care, and treatment.

Data quality control and collection procedure

We have done a pretest on 5% of the total sample size to check the reliability. To assure the quality of data, trained research assistants were collecting the data under the supervision of the principal investigator. Returned questionnaires were also checked daily for consistencies and completeness. We used a structured interviewer-administered questionnaire and chart review to collect clinical data. We measured blood pressure using an aneroid sphygmomanometer after 5 min of rest. Measurement was done with the appropriate cuff size for each patient, in a sitting position, and the arm was bare and supported. Subsequent measurements were done 5 min apart from the first measurement. The average of two separate blood pressure measurements was used in the final analysis. Data were collected on ART follow-up by interviewing eligible participants and reviewing the chart to obtain clinical data.

Statistical analysis

Data were entered using Epi-data version 3.1 and exported to SPSS version 25 for final analysis. Descriptive statistics were computed and presented using tables and narration. We checked multicollinearity and normality with variance inflation factor and Shapiro–Wilk test. Multivariable logistic regression analysis was computed, and the goodness-of-fit model was assessed by Hosmer–Lemeshow statistics. We included variables with $p \leqslant 0.25$ in the bivariable for the final model. The degree of association between outcome and independent variables was computed using AOR with a 95% CI and a p-value of <0.05.

Results

Sociodemographic characteristics of respondents

From a total sample size of 405, 388 persons participated in the study giving a response rate of 95.8%, and 39 years (10.6 SD) was the mean age of the participants. Regarding respondents' residence, more than two-thirds of them were from rural areas. About 42.8% of participants' occupational status were farmers, and more than half (60%) of the respondents were female. Nearly half (48.5%) of the study participants' educational status was unable to read and write, and 70% of them were married. More than two-thirds of participants' family size was greater than three. Of the study participants, 75% got nutritional support and counseling in their ART follow-up care.

Lifestyle-related characteristics

In this study, a majority (94.3%) of the participants were non-smokers and did not chew khat (90.2%). Only 67 (17.3%) of the respondents did regular exercise, and 42 (62.7%) perform regular exercises for more than 30 min. Nearly 307 (80%) respondents did not experience stress symptoms. Regarding alcohol use, the majority 339 (87.4%) of participants were not alcohol drinkers.

Clinical-related characteristics

The majority of 320 (82.5%) study participants did not develop an opportunistic infection. Of the study participants, 361 (93%) were WHO Stage I; the rest 23 (5.9%), and

Table 1. Multivariable logistic regression analysis for factors associated with undiagnosed HTN among HIV-positive patients attending antiretroviral therapy clinics of Butajira General Hospital, Southern Ethiopia. ($n = 388$).

Variables	Category	HTN		95% confidence interval		*p*-value
		No	Yes	COR	AOR	
DM comorbidity	No	301 (83.8%)	58 (16.2%)	1	1	
	Yes	14 (48.3%)	15 (51.7%)	5.56 (2.547, 12.138)	5.29 (2.154, 12.99)	0.009*
Alcohol drinker	No	285 (84.1%)	54 (15.9%)	1	1	
	Yes	30 (61.2%)	19 (38.8%)	3.343 (1.755, 6.365)	2.909 (1.306, 6.481)	0.001*
Duration of ART	<5 years	272 (85.0%)	48 (15.0%)	1	1	
	⩾5 years	43 (63.2%)	25 (36.8%)	3.295 (1.843, 5.888)	3.087 (1.558,6.115)	<0.001*
Age	<40 years	193 (87.3%)	28 (12.7%)	1	1	
	⩾40 years	122 (73.1%)	45 (26.9%)	2.542 (1.506, 4.291)	2.642 (1.450,4.813)	0.002*

ART: antiretroviral therapy; DM: diabetes mellitus.
*$p < .05$.

4 (1.1%) were in WHO Stages II and III. Nearly 20% of participants received ART for more than 5 years of duration. Regarding the prophylaxis status, only 13.7% of participants took prophylaxis. The majority of 364 (96.4%) respondents' ART adherence level was good.

Among the study participants, two-thirds (254 (65.5%)) have normal body mass index (BMI), and 15% of participants have overweight BMI status. Regarding the comorbidity status of study participants, 38 (9.8%) were diagnosed with other comorbidities. Of these, 32 (84.2%) of them used drugs for comorbidities. More than half (210 (54.1%)) of the study participants' current CD4 level was more than 500 cell/μL CD4. Most of the study participants (346 (89.2%)) were taking an ART regimen of 1J Tenofovir disoproxil fumarate (TDF) +3 TC Lamivudine + Dolutegravir (DTG).

The magnitude of undiagnosed hypertension among HIV-positive patients

This study revealed that the overall magnitude of undiagnosed HTN among HIV-positive patients receiving ART was 18.8% (95% CI: 14.7%–23.2%).

Factors associated with undiagnosed hypertension among HIV-positive patients on ART

Variables such as duration on ART, marital status, alcohol drinking, sex, age, khat chewing, viral load, smoking, having diabetes mellitus (DM), prophylaxis therapy, and opportunistic infections were significant variables for undiagnosed HTN in bivariable logistic analysis at p-value < 0.25. In multivariable logistic analysis only, DM, alcohol drinking, duration on ART, and age were significant variables for undiagnosed HTN at p-value < 0.05.

Participants who have DM comorbidity were 5.29 (AOR = 5.29, 95% CI: 2.154, 12.99) times more likely to develop HTN than their counterparts. In this study, HTN was tripled 2.909 (AOR = 2.909, 95% CI: 1.306, 6.481) among alcohol drinkers than nondrinkers. Moreover, respondents who have a longer duration (⩾5 years) of ART were three times (AOR = 3.087, 95% CI: 1.558, 6.115) more likely to develop HTN than those who have <5 years HAART duration. Finally, participants whose age was ⩾40 years were 2.642 (AOR = 2.642, 95% CI: 1.450, 4.813) times more likely to develop HTN than age < 40 years. (Table 1)

Discussion

This study aimed to assess the magnitude and associated factors of undiagnosed HTN among HIV-positive patients attending ART clinics of Butajira General Hospital, Southern Ethiopia. This study demonstrated that the magnitude of undiagnosed HTN among HIV-positive patients was 73 (18.8%), of whom 42 (10.8%) of them were Stage I and 31 (8%) Stage II HTN. Factors such as older age (⩾40 years), HAART duration ⩾5 years, having DM comorbidity, and being an alcohol drinker were significantly associated with undiagnosed HTN.

This study found that the magnitude of undiagnosed HTN among HIV-positive patients was 18.8% (95% CI: 14.7%–23.2%). This finding was consistent with studies done in Malawi,[22] and the United States.[23] However, this finding is much lower than studies conducted in Debre Markos Hospital at 41.3%,[9] northeast Ethiopia at 29.7%,[20] Uganda at 29%,[24] eastern Tanzania at 29.3%,[20] Cameroon at 36.44%,[25] Malaysia at 45.60%,[26] and a study conducted in Tanzania at 25.2%.[27] The above discrepancy might be the difference in inclusion criteria, a study setting, duration of ART, and different sociodemographic characteristics of respondents. In contrast, this study finding is higher than studies done in Harar Jugal Hospital (12.7%),[20] northwest Ethiopia (14%),[28] a study done in Kenya (11.2% and 7.4%) among HIV-positive men and women, respectively,[25] a study done in Parirenyatwa Hospital, Zimbabwe (11.2%),[29] and a study done on HTN prevalence among HIV infected adults in Tanzania (12.5%).[30] The variation might be due to hypertension cutoff point, duration, and regimen of HAART, the difference in socioeconomic and ethnic factors.

This study showed that HIV-positive patients with DM comorbidity were significantly associated with undiagnosed HTN. The current finding is consistent with a study done in eastern Ethiopia; Harar Jugal Hospital revealed that increased glucose level in the blood was significantly associated with HTN prevalence[8] and northeast Ethiopia.[20] The finding is also supported by a previous study on the incidence of HTN in HIV-infected persons, which demonstrated that DM was a strong predictor of HTN.[31] The other justification is as the glucose level increases in the circulating blood, causing widespread damage to blood vessels. Consequently, blood vessels lose their elasticity, fluid volume in the body increases, and insulin resistance may contribute to HTN risks.[32]

In the current study, longer duration of HAART was independently associated with undiagnosed HTN. The finding is in line with studies conducted in northeast Ethiopia,[20] in Harar Jugal Hospital,[8] a comparative study among HIV-positive and the general population in Norway,[33] a study done in South Africa,[34] a systemic review and meta-analysis on the effect of ART on blood pressure level[35] and a cohort study on the association between ART and HTN.[36] This finding is also supported by a study conducted in Spain in which blood pressure increases after 48 h of ART initiation by improving patients' health,[37] a descriptive study in Kenya,[29] and an analytic study in Cameron showed that HAART has a direct impact on blood pressure.[25] Although the effect of HAART duration and increased blood pressure is not well studied, it could be due to either a direct effect on blood vessel walls or an indirect effect of raised blood fats and sugars.[36] The present study is supported by a systemic review and meta-analysis study,[35] and the increment of age-related comorbidities also plays a role as a combined effect for the development of HTN in HIV-positive patients.[38]

In this study, older age was independently associated with HTN. This finding is in line with studies done in northeast Ethiopia,[20] southern Ethiopia,[39] Malaysia,[26] United States,[23] Parirenyatwa hospital,[29] Kenya,[40] Uganda,[24] and a cross-sectional study in Senegal.[41] The possible explanation could be stiffening of arterial vasculature, decreased viscoelasticity property of vessels, and resistance to blood flow occurs in older patients.[42]

Finally, this study finding showed that participants who had alcohol drinking experience were significantly associated with HTN. This finding is in agreement with studies done in Kenya[40] and Eastern Ethiopia.[8] This finding is also supported by clinical studies that state that chronic alcohol consumption of more than three drinks per day contributes to HTN incidence.[43–45] This could be due to consumption of alcohol of more than 20 g of ethanol per day leading to dose-dependent increased blood pressure. As a result, chronic hypertensive effect manifested due to shifting of calcium into vascular smooth muscle cells coupled with an outward shift of magnesium.[46]

It is difficult to ascertain the cause-and-effect relationship due to the nature of the study. Moreover, dietary and genetic factors have not been assessed in this study. Data about lipid profile and renal function cannot be obtained, and there may have a BP measurement bias. The lack of studies that use the new standard hypertension diagnosis guideline makes it difficult to compare our study with previous studies. The use of standard guidelines to diagnose hypertension variables is the strength of the study.

Conclusion and recommendation

The magnitude of undiagnosed HTN among HIV-positive patients attending ART clinics of Butajira General Hospital is high. Age $\geqslant$ 40 years, duration of HAART $\geqslant$ 5 years, patients with DM, and alcohol drinking were factors significantly associated with HTN among HIV-positive patients. This finding implied that all HIV-positive patients attending ART clinics should be routinely monitored for HTN and integrated to improve the negative impacts and enhance the health of HIV-positive patients on ART. For future researchers, it is better to use a prospective study design such as a cohort study to identify predictors of HTN among HIV-positive patients. Future researchers should focus on the service delivery side. More focus on screening HIV-positive patients for HTN is vital, especially participants aged $\geqslant$40 years, HAART duration $\geqslant$5 years, having DM comorbidity, and counseling and creating awareness on the impact of alcohol use on their health.

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Availability of data and materials

The data supporting the finding will be attached to the editorial office with a reasonable request at any time.

Author contributions

B.T.Z. was responsible for literature review, study design selection, data analysis, interpretation, and manuscript drafting. M.S., S.G.T., B.C.T., and Y.S. wrote the first draft of the manuscript. B.T.Z., H.A., Y.M., Z.M., S.T., T.L., and A.A.M. participated in analysis, interpretation, and manuscript review. All the authors contributed to data analysis, drafting, or revising the article, agreed and gave the final approval for the manuscript, and agreed to be accountable for this work.

Consent to publish

It is not applicable because the manuscript cannot contain a person's data in any form (including an individual's detailed images or videos).

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Ethical approval for this study was obtained from Wolkite University College of Medicine and Health Sciences institutional review board with ethical clearance Number: RCSUILC/010/2021.

Ethical consideration

Wolkite University College of Medicine and Health Sciences institutional review board approved the ethical consent. Permission to conduct the study was also obtained from Butajira General Hospital. Written informed consent was obtained from all the subjects before the study. The study was also conducted following the Helsinki Declaration of researches involving human subjects (https://www.who.int/bulletin/archives/79(4)373.pdf).

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Informed consent

Written informed consent was obtained from all the subjects before the study.

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Supplemental material

Supplemental material for this article is available online.

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