Assessment of Blood Pressure Control among Hypertensive Patients in Zewditu Memorial Hospital, Addis Ababa, Ethiopia: A Cross-Sectional Study

Degarege Yazie[1], Workineh Shibeshi[2], Minyahil Alebachew[2] and Alemseged Beyene Berha[2*]

[1]*Department of Pharmacy, Menelik II Referal Hospital, Addis Ababa, Ethiopia*
[2]*Department of Pharmacology and Clinical Pharmacy, School of Pharmacy, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia*

Abstract

Background: Hypertension is a major global concern and public health problem affecting more than one billion individuals worldwide. It is risk factor for cardiovascular diseases (CVDs). The main objective of this study was to determine the prescription pattern of antihypertensive medications among patients on follow-up at cardiac clinic of Zewditu Memorial Hospital.

Method: A cross-sectional retrospective study design was used to collect the data from the patient chart by reviewing the hypertension patient's medical record.

Result: Out of the 356 patient cards reviewed, 204 (57.3%) were for females and with the mean age of 56.2 ± 12.4 years. Among total study participants, 124 (34.8%) had co-morbid conditions. Majority of the patients were on combination therapy 252 (70.8%). Angiotensin converting enzyme inhibitor (ACEI), 215 (60.4%) was the most prescribed drug. Blood pressure was controlled in 107 (30.1%) of patients. About 140 (39.3%) and 134 (37.6%) hypertensive patients were appropriately prescribed according to national guideline 2014 and Joint National Committee (JNC 8) guideline, respectively. The result of the multivariate analysis showed that there was a positive statistically significant association between inappropriate prescription pattern of antihypertensive medications with age ≥ 60 years (P=0.01) and uncontrolled blood pressure (BP) (P=0.001).

Conclusion: In conclusion, the general use of antihypertensive medications seemed not to be in accordance with the Ethiopia national guideline.

Keywords: Blood pressure control; Hypertensive patients; Antihypertensive medication

Abbreviations: ACEI: Angiotensin Converting Enzyme Inhibitor; ARB: Angiotensin II Receptor Antagonist; BB: Beta-blockers; BP: Blood Pressure; CCB: Calcium Channel Blocker; CHD: Coronary Heart Disease; CHF: Congestive Heart Failure; CKD: Chronic Kidney Disease; DBP: Diastolic Blood Pressure; DM: Diabetes Mellitus; JNC: Joint National Committee; LVH: Left Ventricular Hypertrophy; SBP: Systolic Blood Pressure; STG: Standard Treatment Guideline

Background

Hypertension is a major global concern and public health problem affecting more than one billion individuals worldwide and is one of the key preventable risk factors for cardiovascular events [1,2]. The prevalence is projected to increase to 29.0% in men and 29.5% in women by 2025 [3]. There are several published guidelines on classification of hypertension which help physicians in reaching to proper control of hypertension [4]. Blood pressure (BP) for adults age ≥ 18 can be categorized based on stage: pre-hypertension is systolic blood pressure (SBP) 120-139 mm Hg or diastolic blood pressure (DBP) 80-89 mm Hg, stage 1 hypertension SBP 140-159 mm Hg or DBP 90-99 mm Hg and stage 2 hypertension for SBP ≥ 160 mm Hg or DBP ≥ 100 mmHg [5,6].

According to American Society of Hypertension and the International Society of Hypertension treatment with drugs should be started in patients with blood pressures >140/90 mm Hg in whom non-pharmacology treatments have not been effective (R). In patients with stage 2 hypertension drug treatment should be started immediately after diagnosis, usually with a 2 drug combination [5]. There is a wide range of variation in the type of antihypertensive drug class prescription by physicians in different parts of the world [7]. High BP can be treated

medically using several classes of drugs such as angiotensin converting enzyme inhibitors (ACEIs), angiotensin II receptor antagonists (ARBs), beta-blockers (BBs), diuretics and calcium channel blockers (CCBs) being the primary drugs used in treatment [8,9]. Many new effective antihypertensive drugs became available, which gives hypertensive patients more opportunities to have their blood pressure controlled with fewer side effects [4].

Hypertension has been shown as a major risk factor not only for the development of diabetes but also for the development of micro-vascular complications like nephropathy, retinopathy and macro-vascular complications like coronary artery disease, stroke, peripheral vascular disease (PVD) in diabetic patients [10]. Hypertension and diabetes mellitus (DM) frequently coexist which increases with age [11]. The choice of anti-hypertensive drug class is influenced by many factors such as age, race, stage of hypertension and the presence of concomitant disease [12,13]. The Joint National Committee (JNC) seventh report recommended that the BP in diabetics should be controlled to levels of

130/80 mmHg or lower [14]. In adults without compelling indications initial therapy should include thiazide diuretics, ACEIs, CCBs, ARBs or BBs (in those younger than 60 years of age) [7]. But in the presence of high risk conditions, therapy should be started with ACE inhibitors, ARB's, beta blockers or calcium channel blockers alone or in combination with thiazides [14].

Several guidelines for hypertension management recommended rational combination of drugs of different mechanisms of action for effective control of BP because mono-therapy will not achieve the optimal BP goal in the majority of patients [13,15-17], particularly in patient with severe hypertension [17,18]. Compliance will also increase due to fewer side effects [13,16]. Low dose combinations can doubly benefit the patients by being more efficacious and more safe thereby has the potential to improve the quality of life of the patient [19]. Most guidelines recommended that thiazide type diuretics or CCBs or ACEIs could be the first-choice for initial therapy and BBs are not a preferred initial therapy for hypertension [8]. The benefits of ACEIs in preventing cardiovascular events in patients with diabetes mellitus, heart failure, hypertensive renal insufficiency and diabetic nephropathy have been documented [20]. Patients with high blood pressure often have no clinical symptoms until organ damage begins, giving the disease its reputation as a "silent killer" [21].

More than 80% of deaths from hypertension and associated cardiovascular diseases occur in low and middle income countries and this is particularly common among people of low socio-economic status [22]. As in any other developing countries, Ethiopia is challenged by the growing magnitude of chronic non-communicable diseases (NCDs) which created a double burden on the population and the health system which is already hard hit by communicable diseases. Available population based studies indicated high prevalence of NCDs including hypertension, other cardiovascular diseases, diabetes etc, in both rural and urban settings [23]. On the other hand, the Ethiopian health system is designed primarily for the prevention and control of communicable diseases, giving very little emphasis on NCDs [24].

The status of hypertension management is far from being satisfactory [25]. Many studies have demonstrated that lifestyle modifications and adherence to appropriate drug treatments are sufficient to maintain blood pressure at optimal levels. However, available evidence has also shown that about 75% of hypertensive patients do not have optimal blood pressure control [26]. Despite of the availability of a wide range of medications, and increasing awareness of the dramatic impact of BP treatment on reduction of cardiovascular morbidity and mortality, hypertension is still uncontrolled [27]. Control may remain poor as a result of limited resources, poor adherence to medication as well as inappropriate choice of medication. Published evidence has shown that only 50% of physicians complied with guideline recommendations [28]. Therefore, the aim of this study was to assess the management of hypertension among hypertensive patients in Zewditu Memorial Hospital.

Methods

Study setting and period

The study was conducted at Zewditu Memorial Hospital located in centre of Addis Ababa, Ethiopia. It is a teaching and general referral hospital affiliated with Addis Ababa University and under the administration of Addis Ababa city health bureau. This hospital was selected because it is a teaching and referral hospital that provides organized hypertension follow-up care. There were around 274 hypertension patients on treatment receiving services per month in ambulatory cardiac clinic. Around 112,172 patients were served per year in the hospital. The hospital has 872 clinical and non-clinical staff members. The services given in the hospital include hospital pharmacy, cardiac clinic, diabetic clinic, internal medicine, surgery, paediatrics, genecology/obstetrics, psychiatry, neurology, dermatology, HIV clinic, dental clinic and dialysis centre. The study was conducted during the period from July 24-August 23, 2016.

Study design

A retrospective cross-sectional study was employed to conduct the study. Simple random sampling technique was used in the data collection. Data was collected from the patient chart by reviewing the patient's medical record of hypertension patients.

Sample size and sampling method

Sample size was calculated by assuming 0.3 of proportions (p) of hypertension since the prevalence of hypertension in Addis Ababa is estimated to 30% of total population [28], 5% marginal error (d) and confidence interval of 95%. Based on this assumption, the sample size was calculated by single population proportion formula $n=((Z\alpha/2)2 \times p(1-p))/d2$. This yield sample size of 323. Since the source population was less than 10,000 the sample size was adjusted with correction formula and with the assumption of 10% incomplete data, the final sample size was 356 hypertension patients' card.

Data collection and management

Four nurses were recruited and trained for one day to give standardized instruction and clarify data abstraction format. One nurse was assigned to supervise the data collection process. The supervisor and principal investigator closely followed the data collection process at the spot. Data was collected by using a data abstraction format. Although supervision was carried out, daily checking of the collected data was made during data collection by principal investigator. Data collected include sex, age, systolic and diastolic BP readings, duration of antihypertensive therapy, and stage of hypertension, co-morbid conditions (diabetes mellitus, cardiovascular disease and chronic kidney disease), nature of therapy and the antihypertensive medications prescribed.

Data quality assurance

The completeness of the data collected from the survey was checked by the principal investigator in order to maintain consistency. The data abstraction format for the study was prepared in the English language. The data collectors as well as the supervisor were given one day training on the overall data collection procedure. Five percent of the sample was pre-tested to check acceptability and consistency two weeks before the actual data collection.

Data analysis

The data was entered in to computer using EPI-info 3.5.4 software. Data checking and cleaning was done by principal investigator on daily basis during collection before actual analysis. Analysis was done using statistical software for social sciences (SPSS) version 20. Descriptive data was generated and placed in terms of frequency and percentage. Results were expressed as proportions and as Means ± Standard Deviations (SD). The level of BP control was assessed by using the average of three BP records obtained from three different visits [29]. Univariate and multivariate logistic regression was used to analyze the associations between dependent variable and independent variables by

using crude odds ratio (COR) and adjusted odds ratio (AOR) at 95% confidence level. A p-value of less than 0.05 was considered statistically significant.

Ethical consideration

Ethical clearance was obtained from Ethical Review Board of School of Pharmacy, Addis Ababa University. The aim and objectives of the study was explained to the health facility before data collection and permission was obtained from the hospital medical director to access patients' medical record and conduct the study. Consent was not obtained as this study was based on retrospective review of patient medical charts. Privacy and confidentiality was guaranteed by storing data in a safe place, by excluding identifiers (patients' files were coded and name was not recorded).

Results

Socio-demographic and clinical characteristics

A total of 356 hypertensive patients on treatment were included. Out of the 356 patients studied, majority 204 (57.3%) were females. The mean age of patients was 56.2 ± 12.4 years (range 23 to 92 years) .The mean duration on antihypertensive therapy was 11.27 ± 8.34 years (range of 1-51years). Among hypertensive patients 151 (42.4%) have been taking antihypertensive therapy for more than 10 years while 114 (32%) have been taking antihypertensive drugs for 5 to10 years and 91 (25.6%) have been taking antihypertensive drugs for less than 5 years. Age groups were divided into different categories namely, 20-29 years 8 (2.2%), 30-39 years 22 (6.2%), 40-49years 70 (19.7%), 50-59 years 118 (33.1%) and ≥ 60 years 138 (38.8%). Out of the total study participants, 124 (34.8%) hypertensive patients had co-morbid conditions. Among the co-morbid conditions 78 (21.9%) patients were diabetic, 17 (4.8%) patients had CKD, 8 (2.2%) had CHF, 4 (1.1%) had CHD and 1 (0.3%) had LVH, 10 (2.8%) had DM and CKD (Table1).

Appropriateness of the prescription pattern and frequency of antihypertensive medications

Out of the total study subjects, 140 (39.3%) hypertensive patients appropriately prescribed antihypertensive medications according to Ethiopian STG 2014 and 134 (37.6%) hypertensive patients appropriately used according to The Eighth Joint National Committee (JNC 8) guideline (Figure 1).

The overall utilization pattern of antihypertensive agents showed that ACEI was the most frequently prescribed class of drugs 215 (60.4%) followed by CCB 211 (59.3%), BB 167 (46.9%), diuretic 114 (32.0%), Central alpha-2 agonist 9 (2.5%) and ARB 8 (2.3%) (Table 2).

Antihypertensive therapy

Among the study participants, 104 (29.2%) were on mono-therapy and 252 (70.8%) were on combination therapy. Among the study participants who received mono-therapy the most prescribed drugs were ACEI 46 (12.9%), CCB 38 (10.67%), diuretic 9 (2.5%), BB 4 (1.1%), CA2 4 (1.1%) and ARB 3 (0.84%).Concerning patients who were on combination antihypertensive drugs therapy 149 (41.9%) of patients were on two antihypertensive drugs. The most frequently used combinations were ACEI+CCB 35 (9.8%), CCB+BB 33 (9.3%), ACEI + BB 31(8.7%) of the total patients (Table 3). Ninety two (25.8%) patients were on three drugs and among these 46 (12.9%) were on ACEI+CCB+BB and the rest of the triple therapy combinations are shown in Table 4. Eleven (3.1%) patients were received four antihypertensive drugs and among these the most prescribed combinations were diuretic

Variables	Mean ± SD	Frequency (%)
Sex		
Male		152 (42.7)
Female		204 (57.3)
Age categories	56.2 ± 12.4	
20-29		8 (2.2)
30-39		22 (6.2)
40-49		70 (19.7)
50-59		118 (33.1)
≥ 60		138 (38.8)
Duration of therapy (year)	11.27 ± 8.34	
<5		91 (25.6)
5-10		114 (32.0)
>10		151 (42.4)
Co-morbidity		
DM		78 (21.9)
CKD		17 (4.8)
CHF		8 (2.2)
CHD		4 (1.1)
LVH		1 (0.3)
DM and CKD		10 (2.8)
DM and CHF		3 (0.8)
DM and CHD		1 (0.3)
DM and LVH		1 (0.3)
DM, CKD and CHF		1(0.3)

HTN=Hypertension; DM=Diabetes Mellitus; CKD=Chronic Kidney Diseases; CHF=Congestive Heart Failure; CHD=Coronary Heart Disease; LVH=Left Ventricular Hypertrophy

Table 1: The demographic and clinical characteristics of ambulatory hypertensive patients attending Zewditu Memorial Hospital, Ethiopia, 2016.
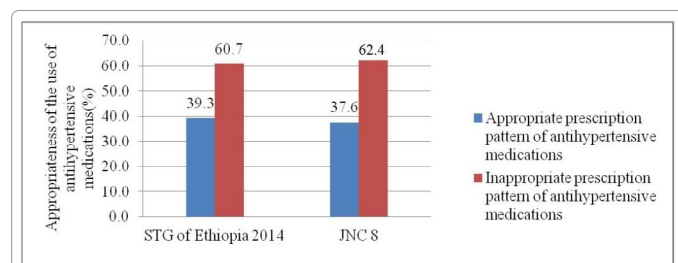

Figure 1: Appropriateness of the prescription pattern of antihypertensive medications according to Ethiopian STG 2014 and JNC 8 guideline among hypertensive patients attending Zewditu Memorial Hospital, Ethiopia, 2016.

+ACEI+BB+CCB, 10 (2.8%) (Table 3).

Prescription pattern of antihypertensive medications in patients with co-morbidities

As shown in Table 4, among the hypertensive cases with diabetes mellitus the most prescribed class of drug was ACEI 64 (68.1%) followed by CCB 54 (57.45%), BB 34 (36.2%), diuretic 20 (21.3%) and ARB and central alpha-2 agonist 1 (1.1%) each. In hypertension patients with CKD, the most prescribed class of drug was CCB 17 (60.7%) followed by ACEI 16 (57.1%), diuretic 16 (57.1%) and BB 7 (25.0%). The most prescribed class of drugs in CHF hypertension patients was diuretic 9 (75.0%) followed by ACEI 6 (50.0%), BB 5 (41.7%), CCB 4 (33.3%) and ARB and central alpha-2 agonist 1 (8.3%) each. The most prescribed class of drug in CHD was ACEI 5 (100.0%) followed by CCB 4 (80.0%), BB 3 (60.0%) and diuretic 1 (20.0%). The commonest prescribed class of drug in LVH hypertension patients was CCB 2 (100.0%) followed

Antihypertensive group	Frequency (%)
ACEI	215 (60.4)
Enalapril	215 (60.4)
CCB	211 (59.3)
Nifedipine	195 (54.8)
Amlodipine	16 (4.5)
BB	167 (46.9)
Atenolol	166 (46.6)
Metoprolol	1 (0.3)
Diuretic	114 (32.0)
Hydrochlorothiazide	82 (23.0)
Furosemide	32 (9.0)
ARB	8 (2.3)
Losartan	7 (2.0)
Candesartan	1 (0.3)
Central alpha-2 agonist	9 (2.5)
Methyldopa	9 (2.5)

ACEI=Angiotensin Converting Enzyme Inhibitor; BB= Beta Blocker; ARB=Angiotensin Receptor Blocker   CCB=Calcium Channel Blocker

Table 2: Frequency of administration of individual antihypertensive medications among hypertensive patients attending Zewditu Memorial Hospital, Ethiopia, 2016.

Nature of therapy	Frequency (%)
Mono-therapy	104 (29.2)
ACEI	46 (12.9)
CCB	38 (10.7)
Diuretic	9 (2.5)
LD	5 (1.4)
TD	4 (1.1)
BB	4 (1.1)
Ca2	4 (1.1)
ARB	3 (0.56)
Dual therapy	149 (41.9)
ACEI + CCB	35 (9.8)
ACEI+BB	31 (8.7)
CCB+BB	33 (9.3)
ACEI+diuretic	23 (6.5)
CCB+diuretic	15 (4.2)
BB+diuretic	8 (2.2)
diuretics+CA2	2 (0.84)
ARB+diuretic	1 (0.3)
ARB+CCB	1 (0.3)
Triple therapy	92 (25.8)
ACEI+BB+CCB	46 (12.9)
BB+CCB+diuretic	20 (5.6)
ACEI+BB+diuretic	12 (3.4)
ACEI+CCB+diuretic	9 (2.5)
ACEI+diuretic+CA2	3 (0.8)
ARB+BB+CCB	1 (0.3)
ARB+BB+diuretic	1 (0.3)
Four drugs therapy	11 (3.1)
ACEI+BB+CCB+diuretic	10 (2.8)
ARB+BB+CCB+diuretic	1 (0.3)

ACEI=Angiotensin Converting Enzyme Inhibitor; BB= Beta Blocker; ARB=Angiotensin Receptor Blocker; CCB=Calcium Channel Blocker; CA2=Central Alpha-2 Agonist; LD = Loop Diuretic; TD =Thiazide Diuretic

Table 3: Antihypertensive therapy among hypertensive patients attending Zewditu Memorial Hospital, Ethiopia, 2016.

Co-morbid condition	N	ACEI N (%)	CCB N (%)	BB N (%)	Diuretic N (%)	ARB N (%)	CA2 N (%)
DM	94	64 (68.1)	54 (57.45)	34 (36.2)	20 (21.3)	1 (1.1)	1 (1.1)
CKD	28	16 (57.1)	17 (60.7)	7 (25.0)	16 (57.1)	0	0
CHF	12	6 (50.0)	4 (33.3)	5 (41.7)	9 (75.0)	1 (8.3)	1 (8.3)
CHD	5	5 (100.0)	4 (80.0)	3 (60.0)	1 (20.0)	0	0
LVH	2	1 (50.0)	2 (100)	0	0	0	0

DM=Diabetes Mellitus; CKD=Chronic Kidney Diseases; CHF=Congestive Heart Failure; CHD=Coronary Heart Disease; LVH=Left ventricular hypertrophy; ACEI=Angiotensin Converting Enzyme Inhibitor; BB= Beta Blocker; ARB=Angiotensin Receptor Blocker; CCB=Calcium Channel Blocker; CA2=Central Alpha-2 Agonist; N=Frequency

Table 4: Prescription pattern of antihypertensive medications among hypertensive patients with various co-morbidities attending Zewditu Memorial Hospital, Ethiopia, 2016.

by ACEI 1 (50.0%). But in case of hypertension patients without compelling conditions the most prescribed class of drug was CCB 141 (60.8%) followed by ACEI 131 (56.5%), BB 126 (54.3%), diuretic 76 (32.8%), CA2 7 (3.0%) and ARB 6 (2.6%).

Blood pressure control

Among the study participants 137 (38.5%) had a controlled SBP; while 174 (48.9%) had a controlled DBP. The overall control of BP was achieved in 107 (30.1%) of the study participants according to national guideline (STG, 2014) (Figure 2).

Determinants of the appropriate prescription pattern of antihypertensive medications

The association of independent variables with the dependent variable was investigated using both univariate and multivariate logistic regression. Only two variables were shown to have significant association with the appropriateness of the prescription pattern of antihypertensive medications. The result of the multivariate analysis showed that there was a positive statistical significant association between inappropriate prescription pattern of antihypertensive medications and age ≥ 60 years (P<0.05) and uncontrolled BP (P<0.05). Patients with controlled BP were two fold more likely to have appropriate prescription pattern of antihypertensive medications when compared patients with uncontrolled BP (AOR=0.45, 95% CI: 0.27-0.73, P=0.001) (Table 5).

Discussion

This study was a retrospective cross sectional study designed to assess the pattern of antihypertensive medications in order to obtain an insight into the current utilization of antihypertensive drugs in Zewditu Memorial Hospital. Blood control status was found to be associated with inappropriate prescription pattern of antihypertensive medications when compared patients with controlled BP. The result of the current study showed that only one third of hypertensive patients
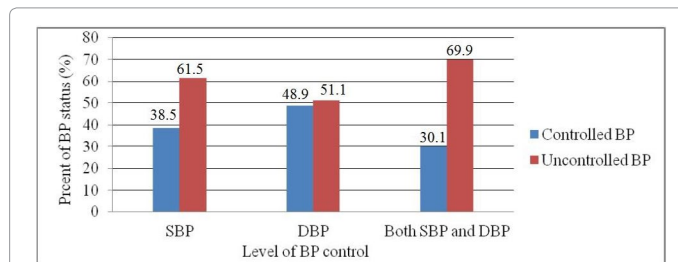

Figure 2: Blood pressure control among hypertensive patients attending Zewditu Memorial Hospital, Ethiopia, 2016.

Variables	Appropriate prescription pattern of antihypertensive medications		COR(95% CI)	AOR(95% CI)	P-value
	Yes (%)	No (%)			
Sex					
Female	79 (22.2)	125 (35.1)	1.00	1.00	
Male	61 (17.1)	91 (25.6)	0.94 (0.62, 1.45)	1.14 (0.71, 1.82)	0.58
Age category					
< 60 years	72 (20.2)	146 (41.0)	1.00	1.00	
≥ 60 years	68 (19.1)	70 (19.7)	0.51 (0.33, 0.79)	0.54 (0.34, 0.87)	0.01
Co-morbid condition					
HTN alone	92 (25.84)	140 (39.33)	1.00	1.00	
DM	36 (10.1)	42 (11.8)	0.77 (.46, 1.29)	0.83 (0.48, 1.43)	0.50
CKD	7 (1.97)	10 (2.8)	0.94 (.35, 2.56)	0.89 (0.32, 2.50)	0.82
DM and CKD	4 (1.12)	6 (1.69)	0.99 (.27, 3.59)	0.90 (0.24, 3.36)	0.88
CHD	1 (0.3)	4 (1.1)	2.63 (0.39, 23.90)	3.14 (0.33, 30.02)	0.32
BP status					
Controlled	57 (16.0)	50 (14.0)	1.00	1.00	
Uncontrolled	83 (23.3)	166 (46.7)	2.28 (1.44, 3.62)	0.45 (0.27, 0.73)	0.001

Others*: BB, ARB, ARB+Diuretic, CA$_2$, ARB+CCB, CCB+BB, CA$_2$ + Diuretic, CCB+BB+Diuretic, ARB+CCB+BB+Diuretic, ARB+BB+CCB, ARB+BB+Diuretic and ACEI+Diuretic+CA$_2$.

ACEI=Angiotensin Converting Enzyme Inhibitor; BB=Beta Blocker; ARB=Angiotensin Receptor Blocker; CCB=Calcium Channel Blocker; CA2=Central Alpha-2 Agonist; HTN=Hypertension; DM=Diabetes Mellitus CKD=Chronic Kidney Diseases; CHD=Coronary Heart Disease

Table 5: Determinants of the appropriate use of antihypertensive medications among hypertensive patients attending Zewditu Memorial Hospital, Ethiopia, 2016.

on pharmacologic treatment had a controlled BP 107 (30.1%). The level of BP control found in this study was similar to the study conducted in Nigeria (30.5 %) [20]. The present study revealed similar result with the health centre based study (31%) [29]. This similarity might be due to the study conducted in the same geographic area and similar inclusion criteria. But the level of BP control found in this study was lower than the studies from Saudi Arabia (72%) [30], Italy (43.23%) [31] and Togo (54.4%) [32]. This difference in the level of BP control might be due to a more aggressive therapy with two or more drug combinations. The racial difference might have contributed to this inconsistency. Moreover, the level of BP control in the present study a little bit higher than the study performed two years ago (26.2%) by Adugna, this difference might be due to the use of different guidelines as a standard. But the level of BP control in the present study was higher than the study performed (15%) by Abera et al. [33].This difference might be due to patients with co-morbid conditions difficult to achieve target BP easily and in case of the study conducted by Abera et al. all hypertension patients had DM.

Some of the reasons attributed to the inadequate BP control were reported to be poor compliance with medications which is strongly determined by poverty, excessive salt intake, use of non-steroidal anti-inflammatory drugs (NSAIDs) and inappropriate combinations with inadequate dosing of antihypertensive agents was revealed by Etuk et al. [20]. The result of the current study showed that only 140 (39.3%) and 133 (37.4%) of hypertensive patients on pharmacologic treatment had appropriate use of antihypertensive medications according to Ethiopian national guideline (STG 2014) and JNC 8 guideline respectively. This small difference might be because of the prescription pattern of antihypertensive medications in JNC 8 consider the racial difference. Among the limitation of this study, the status of patients' compliance to prescription and patients' lifestyle change were significantly affected the outcome of medication but were not reported in this study. The prevalence of appropriate use of antihypertensive medications found in this study (39.3%) was lower than the studies from Saudi Arabia

(60%) [30], Malaysia (85.3%) [34], Ethiopia (97.0%) [1] and published evidence has shown that 50% of physicians complied with guideline recommendations [28,35]. In the present study appropriate use of antihypertensive medications was found to be low which might be associated with the adherence of the prescriber to the national STG.

The results of the present study indicated that the proportion of females with hypertension 204 (57.3%) was high. This study was in line with two Ethiopian studies [1,36] and Nigeria study [16]. In contrary, the present study was inconsistence with other studies which were conducted in Bangladesh [37] and India [38]. The result of the multivariate analysis showed that age was significantly associated with inappropriate prescription pattern of antihypertensive medications in patients age ≥ 60 years (AOR=0.54, 95% CI: 0.34, 0.87, P=0.01). This study also revealed that 256 (71.9%) of hypertension patients were age over 50 years. The current study was in line with the study conducted in Ethiopia [1] and India [39]. These results showed that age may affect the incidence of hypertension.

The classes of antihypertensive agents prescribed in this study were ACEI 215 (60.4%), CCB 211 (59.3%), BB 167 (46.9%), diuretic 114 (32.0%), CA2 9 (2.5%) and ARB 8 (2.3%). Results resembling such pattern in the use of antihypertensive drugs were observed in a tertiary care hospital based study from India which reported that the most frequent group of antihypertensive medication was ACEI (44.25%) by Arief et al. [40] and the study conducted in the current study area two years ago [41] . ACEI was the first line antihypertensive drug for hypertension patients and the result of the study was comparable with the current national guidelines of Ethiopia 2014 (STG).

In the present study, the overall prescription pattern of antihypertensive medication was inconsistent with a study conducted in a general hospital in China, CCB (58.0%), ARB (34.2%), ACEI (17.5%), BB (16.9%) and diuretic (16.7%) [8]. This difference might be due to age variation of the study participants. In the present study the majority

of the patients were younger than 60 years with a mean age of 56.2 ± 12.4 but the study conducted in China the majority of the patients were older than 60 years with the mean age was 61.3 ± 13.7 years.

According to the study conducted in India by Cidda et al. [9], the most common drug class involved in the study was ARB (42.24%). This discrepancy might be due to cost variation across the study places. The result of cost evaluation showed that diuretics had the lowest cost and ARBs had the highest cost per day [34,42].The study also conducted in Malaysia the most prescribed antihypertensive medications were BBs (85.9%) [34]. The discrepancy of the use of BB over ACEI might be associated with the prevalence of types of co-morbid condition since the majority of the patients in Abdulameer et al. [28] study occurred with CHD. On the contrary, the study conducted in Addis Ababa health centres showed that the most commonly used antihypertensive drugs were thiazide diuretics (36.5%). This difference in frequent use of ACEI over diuretic might be due to the high prevalence of co-morbid conditions (i.e. DM and CKD).

In the current study, BB which was considered as a second line antihypertensive agent; it was reported to be used in 167 (46.9 %) of the hypertensive patients. This discrepancy might have resulted from lack of adherence to national guideline (STG). Since BB is a second line drug this result showed that BB was inappropriately prescribed. Beta blockers should only be prescribed when compelling conditions such as CHF and CHD are co-diagnosed regards to Ethiopian STG 2014. But in case of this study these two diseases were 17 (4.8%) only.

The result of the study showed that majority of the patients were on combination therapy 252 (70.8%) which was consistent with the study conducted in Nigeria, 2008 (80%) [20] in Togo, 2012 (81.40%) [32] and the study conducted in Ethiopia by Adugna, (83.1%) [41]. The present result and the study conducted by Adugna [41] showed that combination therapy practice had consistency. But higher than the study which was done in Ethiopia (34.5%) [1], Bangladesh (38.4%) [37] and China (37.1%) [8]. The higher prescription rate of combination therapy might be due to the longer duration of hypertension therapy and being high risk patients. Moreover, according to the study conducted in Addis Ababa health centres, Ethiopia the majority of the patients were on mono-therapy (78.9%) [29]. The present study was inconsistent with the above study might be due to the hospital based patients presented with severe and more complicated hypertension since they are referred from the health centre.

Out of 104 (29.2%) patients who received mono-therapy ACEI, 46 (44.2%) was the most prescribed drug. This study was similar to a study conducted in India which showed that ACEI (38.25%) was the most prescribed drug [40]. On contrary, the study conducted in Addis Ababa health centres showed that Ca2 (methyldopa) was the most common mono-therapy used (20.8 %) [29]. This discrepancy might be because of the difference in level of knowledge on the management of hypertension.

According to the Ethiopian guideline 2014, mono-therapy was only preferred if the target blood pressure was achieved successfully by that particular antihypertensive agent. But if the target blood pressure was not achieved with one agent, then poly-therapy should be introduced and low doses of two or more agents should be given. Nature of therapy was also found to have association with inappropriate prescription pattern of antihypertensive medications in that when compared with mono-therapy. The most frequently used two drug combinations were ACEI+CCB, 35 (9.8%).This combination is strongly supported by the national guideline for patients without co-morbid conditions [43]

hence the prescribers might be familiar with this combination. This study was similar to a study conducted in India [40]. On the other hand, the study conducted in Nigeria CCB+diuretic (36.6%) were the most frequently used combinations [44]. This difference might be due to the variations of the prevalence of the types of co-morbid condition and the recommended guidelines. Moreover, the study conducted by Adugna [41] in Zewditu Memorial Hospital, Ethiopia the most frequently used two drug combination was ACEI+BB (14.2%). This difference might be associated that in the present study the prescriber's awareness for the national guideline was improved.

Regarding patients who were on three antihypertensive therapies ACEI+CCB+ BB combinations were the most prescribed drugs. This study showed similarity with the survey conducted in India [18]. With respect to patients receiving four antihypertensive drugs therapy the most frequently used combinations were ACEI+diuretic+BB+CCB. On the other hand, the study conducted in Nigeria the most frequently used combinations were ACEI+CCB+diuretic+methyldopa [16]. The observed difference of this study with the above study might be attributed to the possibility of some patients presenting with multiple co-morbid conditions.

The result of the current study showed that among the study participants on mono-therapy 41 (40.6%) had controlled blood pressure while among patients on combination therapy 68 (26.7%) had controlled BP. The current study showed similarity with a study conducted in Nigeria with mono-therapy 41.4% had BP controlled and with combination therapy 17.9% had controlled BP [17]. In contrary, another study conducted in Nigeria showed that with mono-therapy 34.4% had BP controlled and with combination therapy 47.2% had controlled BP [45]. The higher proportion of controlled BP with mono-therapy when compared with combination therapy might be associated with the more appropriate prescribed pattern of mono-therapy.

According to the present study the most prevalent co-morbid disease was DM. Similarly, the most prevalent co-morbid disease was DM according to many studies reported [1,15,36,38,46]. The increase incidence of DM in hypertensive patients might be due to factors which have been proposed to contribute to hypertension in diabetes: hyperinsulinemia, extracellular fluid volume expansion and increased arterial stiffness [47]. Among the hypertensive cases with DM, the most prescribed class of drugs was ACEI 64 (68.1%). This study showed similarity with a study conducted in Saudi Arabia; ACEI (about 75.0%) [30] and in diabetic clinic at Zewditu Memorial Hospital, Ethiopia; ACEI (84%) [33]. ACE-inhibitors are the only class of drugs that are often prescribed to diabetic hypertensive patients, as these drugs prevent the chance of occurrence of retinopathy and other related complications [40]. On the other hand, the study conducted in Nigeria the most prescribed class of drug was diuretic (61.5%) [20] and in China CCB (61.7%) [8]. These differences in result might be due to the status of prescribers' awareness about the national and international guidelines and the presence of other compelling conditions.

The commonest prescribed class of drug in CKD hypertension patients was CCB 17 (60.7%). This study was in line with the studies conducted in China CCB (56.4%) [8] and Saudi Arabia CCB (about 40%) [30]. But the study conducted in Nigeria the first choice drug was diuretic (91.7%) [20]. In the current study, CCB was preferred to treat hypertensive patients with CKD in contrast to guideline that recommended ACEI/ARB. Seventh Report of the Joint National Committee guidelines advocate ACEIs as the favored drug for hypertension associated with chronic kidney disease, diabetes or congestive heart failure [35]. The most prescribed class of drug in

CHF hypertension patients were diuretics 9 (75.0%). Similar study was conducted in Nigeria and the most prescribed drugs were diuretic (100%) [20]. On the other hand, the study conducted in China has shown that CCB (61.7%) was the most prescribed drug [8]. In the current study the preferred drug was diuretic as first line to treat hypertensive patients with CHF in contrast to guideline that recommended ACEI/ARB + metoprolol/carvedilol. The present study showed that the physicians might not be paid sufficient attention to the benefits of ACE inhibitor as the first line drug in treatment of co-morbidities (CHF and CKD) associated with hypertension.

The most prescribed class of drug in CHD was ACEI 5(100.0%) followed by CCB 4 (80.0%). In the present study the preferred drug was ACEI (100.0%) to treat hypertensive patients with CHD and also it was consistent with the guideline [43]. The commonest prescribed class of drugs in hypertension patients with LVH was CCB 2 (100.0%). The result of the present study showed that 100% not in accordance with the national guideline (Ethiopian STG 2014). Since the first choice of hypertension patients with LVH was ACEI/ARB and the second line was thiazide diuretics but CCB even not an alternative choice according to Ethiopian STG 2014. But in case of hypertension patients without co-morbid conditions the most prescribed class of drugs was CCB (60.8%). This study was in line with the study conducted in China which showed that the most prescribed class of drug was CCB (56.4%) [8]. In the present study CCB was first choice of class of antihypertensive which might be associated with the racial difference.

Conclusion

Overall utilization pattern of antihypertensive medications indicates that ACEI and CCB were the most frequently prescribed class of drugs in both mono-therapy and combination therapy. There was underutilization of diuretics in this study, in spite of reasonable evidences backing their prescription. Uncontrolled BP and age ≥ 60 years were positively associated with inappropriate prescription pattern of antihypertensive medications. Despite the use of different antihypertensive drugs, most of the patients did not achieve the target blood pressure and the general use of antihypertensive medications, as observed in this study, is not to be in accordance with the national guideline of Ethiopia for management of hypertension.

Declarations

Ethics approval and consent to participate

The study was approved by Ethical Review Board of School of Pharmacy, Addis Ababa University. However, no consent was needed as the study was based on retrospective chart review.

Authors' contribution DY conceived the idea for the study, designed it, collected data, performed data analysis, and wrote parts of the introduction, methods, results and discussion sections of the research. MA, WS and ABB participated in the design, collected data, and contributed to the writing of the methods and results sections. All authors are responsible for the drafting, review and final approval of the manuscript.

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