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Antihypertensive Drug Regimen for High Blood Pressure Associated with Modifiable Cardiovascular Risk Factors Among Hypertensive Patients Attending Campus Teaching Hospital of Lomé, Togo, West Africa

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Abstract

Objective: The present prospective study was aimed to target the antihypertensive drug regimen for HBP associated with modifiable cardiovascular risk factors such as stressful and sedentary lifestyle, obesity, diabetes and chronic ethylism among hypertensive patients.

Material and Method: This study was conducted among outpatients and inpatients attending the department of cardiology of Campus Teaching Hospital for hypertension conditions associated with comorbidities (stressful, sedentary lifestyle, obesity, diabetes and ethylism) and placed on antihypertensive drug therapy.

Results: Of the 112 patients treated for HBP, 43 (38.39%) received an ambulatory treatment and 69 (61.61%) were hospitalized. Of 43 outpatients, 37.21% and 18.60% vs 24.64%, 34.78% and 23.19% of 69 inpatients presented respectively 2, 3 and ≥ 4 concomitant modifiable risk factors. Regarding the antihypertensive drug regimens received and concomitant risk factor profile of patients, significant reduction of Systolic Blood Pressure (SBP) among patients with 3 risk factors and Diastolic Blood Pressure (DBP) among patients with at least, together with chronic ethylism, another risk factor among stressful, sedentary lifestyle, obesity and diabetes, was observed. In cases of complicated HBP, outpatients with 3 concomitant risk factors against inpatients with high stress, sedentary lifestyle and obesity were placed on diuretic (D), Calcium Channel Antagonist (CCA) and Angiotensin Converting Enzyme Inhibitor (ACEI) as first choice in monotherapy or in addition to Centrally Acting Antihypertensive Drug (CAAD) in suitable combinations in 2/3 of total combinations prescribed.

Conclusion: antihypertensive drug regimens from mono to quadruple therapy allowed to control significantly SBP in patients with 3 concomitant modifiable risk factors and DBP among patients with at least, together with chronic ethylism, another risk factor among stress, sedentarity, obesity and diabetes. In complicated HBP with concomitant modifiable risk factors, D or CCA or ACEI or in suitable combinations in addition to CAAD were the favorite pharmacological groups prescribed.

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Keywords: Antihypertensive Drug Regimen; Combination of Modifiable Cardiovascular Risk Factor; Hypertensive Patients; Number and type of Modifiable Cardiovascular Risk Factors; Togo

Abbreviations:

ACEI Inhibitor	:	Angiotensin Converting Enzyme
CAAD Drug	:	Centrally Acting Antihypertensive
CCA	:	Calcium Channel Antagonist
D	:	Diuretic
DBP	:	Diastolic Blood Pressure
ESH	:	European Society of Hypertension
ESC	:	European Society of Cardiology
HBP	:	High Blood Pressure
SBP	:	Systolic Blood Pressure
WHO	:	World Health Organization

Introduction

Essential High Blood Pressure (HBP) has become a great concern in Togo in terms of prevalence, morbidity and mortality as shown by previous studies [1,2]. Antihypertensive drugs, in addition to an adequate dietetic regimen, are the most efficient way of managing HBP. These drugs are used either in monotherapy or most often in bi-, tri- or quadritherapy with molecules from different pharmacological groups; hence the difficulty in the choice of a better synergy and lesser risk. HBP pharmacotherapy, which requires a high level of adherence, aims at the reduction of BP cardiovascular risks (myocardial infarction, cerebra-vascular accident and stroke) [3-5] without adversely affecting the patients' quality of life.

Previous studies have targeted various modifiable cardiovascular risk factors such as HBP, high stress, sedentary lifestyle, low physical exercise, obesity or chronic ethylism [6] in the occurrence of cardiovascular diseases. To the best of our knowledge, the present prospective study, the first of its type in Togo for which very little data is available in the literature, intends to target the antihypertensive drug therapy that controlled HBP according to patient characteristics (number and modifiable risk factors profile : stressful and sedentary lifestyle, obesity, diabetes and chronic ethylism). The findings presented in this study could permit to target the suitable antihypertensive drug regimen according to HBP's conditions in association with the number, the type and combinations of such modifiable risk factors.

Methods

Eligible Patients

The criteria for enrolment was all patients having consulted or having been referred to or hospitalized in the department of cardiology of Campus Teaching Hospital. It also includes patients whose diagnosis of HBP has shown (BP higher than the limits defined by the World Health Organization (WHO)), i.e., 140 mmHg for Systolic Blood Pressure (SBP) and 90 mmHg for diastolic blood pressure (DBP). Patients were submitted to a check-up and then placed on antihypertensive drug therapy. Patients with irregular follow up visits, for whom collected data was incomplete, or whose adherence was poor, and those who claimed to take a traditional remedy in addition to the prescribed treatment, were excluded from the study.

Material

Blood pressure was measured using a Spengler mercury sphygmomanometer with an armband for adult of 12 cm large together with a Spengler stethoscope. The patients' weight was taken on a SECA scale with a maximum load of 150 kg.

Data Collection Method and Variable of Interest

The present study is prospective, covering a period of one year. It has been conducted among the outpatients and inpatients attending the department of cardiology of Campus Teaching Hospital for hypertension conditions. A questionnaire allowed us to collect the information regarding age and gender as non-modifiable factors, the hospitalized or ambulatory status, the BP level before and after being placed on antihypertensive therapy, the antihypertensive therapy regimens prescribed and the patients' modifiable risk factors associated to HBP such as stressful, sedentary lifestyle, obesity, diabetes and ethylism. Each modifiable factor was assessed as following:

Stressful lifestyle: Includes stressful profession and work, personality (psychological profile of type A), agitated, with domestic conflicts;

Sedentary lifestyle: Less than 30 minutes of sporty activity per day;

Obesity: Body Mass Index (BMI) more than 30g/m^2;

Diabetes: Blood glucose level more than 1.1g/L in the morning in an empty stomach;

Chronic ethylism: Daily consumption of alcohol, more than 3 glasses of wine per day or equivalent amount for other alcoholic drinks.

The BP was measured using the auscultator method at rest, in a quiet environment.

The status of hypertension control was classified as controlled or uncontrolled hypertension using the limits defined previously. The mean difference between baseline SBP/DBP and that obtained after placing patients on antihypertensive therapy was calculated. These mean differences were used to compare treated groups.

Study Limits

In the modifiable cardiovascular risk factors, dietary habits, patients' lipidic profile have not been taken into consideration in the analysis of the results. The survey was not interested in the undesirable events that could occur in the course of the treatment. The size of some tested groups was limited and could not be analyzed. At the period of the study, the Ministry in charge of the Health authorized the survey. Data collection was done in the absolute anonymity.

Statistical Analyses

The treated groups according to the number and the type of modifiable cardiovascular risk factors were compared in two ways ANOVA followed by Tuckey's multiple comparisons test (Graph Pad Prism v6.07). Differences were considered significant for $p < 0.05$.

Results

Number, Type and Combinations of Modifiable Risk Factors Associated to HBP Among Ambulatory and Hospitalized Patients

Of the 112 patients treated for HBP, 43 (38.39%) received an ambulatory treatment and 69 (61.61%) were hospitalized. Distributions of patients according to the number or combination of concomitant risk factors in a patient are presented in Table 1,2, respectively. Among patients who normalized their BP under antihypertensive drug therapy, 37.21%, 37.21% and 18.60% outpatients vs 24.64%, 34.78% and 23.19% inpatients respectively presented cumulatively 2, 3 and ≥ 4 modifiable cardiovascular risk factors (Table 1).

Number of modifiable cardiovascular risk factors	Ambulatory patients		Hospitalized patients	
	n1	%	n2	%
0 risk factor	2	4.65	2	2.90
1 risk factor	1	2.33	10	14.49
2 risk factors	16	37.21	17	24.64
3 risk factors	16	37.21	24	34.78
≥ 4 risk factors	8	18.60	16	23.19
TOTAL	**43**	**100**	**69**	**100**

Table 1: Distribution of patients according to the number of modifiable risk factors in addition to HBP among ambulatory patients (n1 = 43) and hospitalized patients (n2 = 69).

Type of modifiable cardiovascular risk factors	Ambulatory patients		Hospitalized patients	
	n1	%	n2	%
Stress	1	2.32	5	7.25
Stress + sedentary	10	23.26	6	8.70
Stress + sedentary + diabetes	2	4.65	2	2.90
Stress + sedentary + obesity	10	23.26	9	13.04
Chronic ethylism with another risk factor among stress, sedentary, obesity, diabetes	12	27.91	32	46.38
Others	8	18.60	15	21.73
TOTAL	**43**	**100**	**69**	**100**

Table 2: Distribution of patients according to the type and combinations of modifiable risk factors in addition to HBP among outpatients (n1 = 43) and inpatients (n2 = 69).

Outpatients with HBP associated with stressful and sedentary lifestyle were 23.26% vs 8.70% for inpatients. Life conditions including both stressful lifestyle, sedentary lifestyle and obesity in addition to HBP represented 23.26% of outpatient's vs 13.04% for inpatients. Patients with modifiable cardiovascular risk factors as at least, together with chronic ethylism, another risk factor among stressful lifestyle, sedentary lifestyle, obesity and diabetes in addition to HBP were 27.91% (outpatients) against 46.38% (inpatients) (Table 2).

Blood Pressure Control Among Ambulatory and Hospitalized Patients According to The Number of Modifiable Risk Factors

Figure 1 shows the effect of antihypertensive treatment on SBP and DBP reduction among outpatients and inpatients according to the number of concomitant modifiable risk factors. SBP reduction in patients with 3 risk factors was statistically significant ($p < 0.05$; two-way ANOVA followed by Tuckey's multiple comparisons test). The reduction of BP was significantly greater in hospitalized patients compared to those who received an ambulatory treatment ($p < 0.0001$ for SBP; $p = 0.0006$ for DBP; two-way ANOVA).

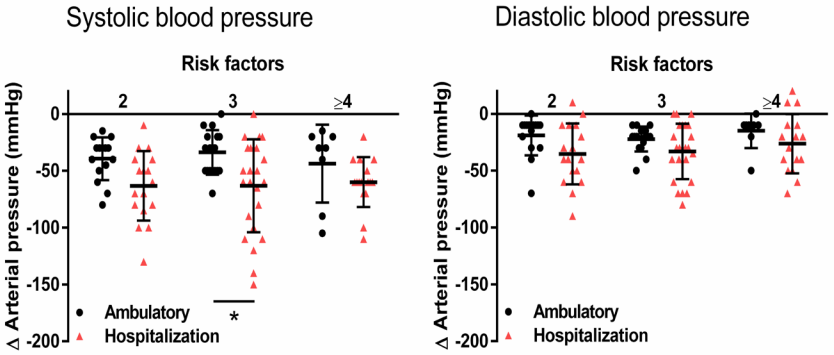

Figure 1: Effect of the number of modifiable risk factors accumulated in a subject (out-patient's vs inpatients) on the SBP and DBP reduction. *p<0.05; two-way ANOVA followed by Tuckey's multiple comparisons test.

Blood Pressure Control Among Ambulatory and Hospitalized Patients According to The Type and Combinations of Modifiable Risk Factors

The effect of antihypertensive treatment on SBP and DBP reduction among outpatients and inpatients according to the modifiable cardiovascular risk factors profile (type and combination) is shown in Figure 2. The findings show significant DBP reduction in patients with at least, together with chronic ethylism, another risk factor among stressful, sedentary lifestyle, obesity and diabetes (p<0.05; two-way ANOVA followed by Tuckey's multiple comparisons test). The reduction of BP was again significantly greater in hospitalized patients compared to those who received an ambulatory treatment (p = 0.0005 for SBP; p = 0.0077 for DBP; two-way ANOVA).

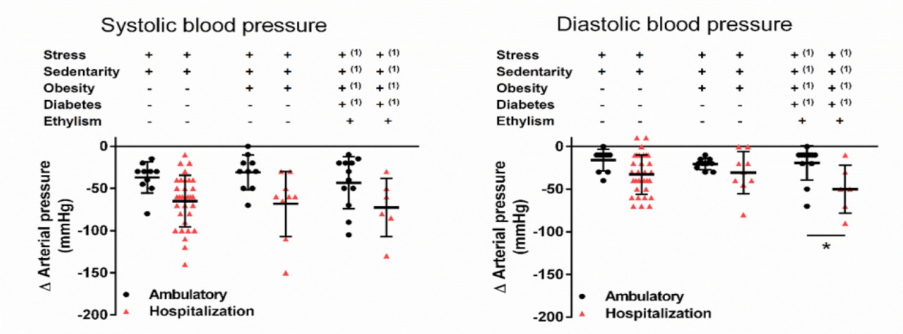

Figure 2: Effect of the type and combinations of modifiable risk factors accumulated by a subject (out or inpatients) on the SBP and DBP reduction. (1) Patients in this group present at least, together with chronic ethylism, another risk factor among stress, sedentary, obesity and diabetes. *p<0.05; two-way ANOVA followed by Tuckey's multiple comparisons test.

Profile of Antihypertensive Drug Regimens Prescribed Among Outpatients Compared to Inpatients According to The Number of Modifiable Risk Factors

The following Tables 3-5 show the profile of antihypertensive drug regimens prescribed among patients suffering from HBP associated with respectively 2, 3 and ≥ 4 modifiable cardiovascular risk factors. These regimens include various pharmacological groups and range from mono to quadritherapy. Among patients with two cardiovascular risk factors in addition to HBP, physicians prescribed up to three antihypertensive drugs among outpatient's vs up to four antihypertensive drugs among inpatients. Moreover, they used bitherapy including a diuretic among ambulatory patients while hospitalized patients were placed under bitherapy with and without diuretic (CCA + CAAD or ACEI or BB + ACEI). All other combinations consisted in 3 or 4 antihypertensive drugs prescribed, including at least one diuretic.

2 risk factors	
Ambulatory patients	Hospitalized Patients
Monotherapy	
2 x CCA 1 x ACEI	1 x CCA 1 x ACEI
Bitherapy	
2 x D + CCA 3 x D + ACEI 3 x D + CAAD	1 x CCA + ACEI 4 x D + ACEI
	1 x BB + ACEI 2 x CCA + CAAD
Tritherapy	
2 x D + CCA + ACEI 1 x D + CCA + CAAD 2 x 2D + CAAD	1 x D + CCA + ACEI 1 x D + CCA + CAAD
	1 x D + ACEI + CAAD 1 x D + ACEI + BB
Quadritherapy	
No quadritherapy regimen	2 x D + CCA + ACEI + CAAD 1 x D + CCA + ACEI + BB
D: Diuretic; CCA: Calcium Channel Antagonist; ACEI: Angiotensin-Converting Enzyme Inhibitor; CAAD: Centrally Acting Antihypertensive Drug; BB: Beta-Blocker	

Table 3: Profile of antihypertensive drug regimens prescribed among ambulatory and hospitalized patients with 2 concomitant modifiable risk factors in addition to HBP.

3 risk factors	
Ambulatory patients	Hospitalized patients
Monotherapy	
2 x CCA 1 x BB 1 x D	No monotherapy regimen
Bitherapy	
2 x 2D 5 x D + ACEI 1 x ACEI + CAAD	2 x D + CCA 1 x CCA + CAAD 5 x D + ACEI
Tritherapy	
2 x D + CCA + CAAD 1 x D + ACEI + CAAD 1 x 2D + CAAD	2 x D + CCA + ACEI 3 x D + CCA + CAAD 3 x D + ACEI + CAAD 1 x CCA + ACEI + BB
Quadritherapy	
No quadritherapy regimen	4 x D + CCA + ACEI + CAAD 1 x 2D + CCA + BB 1 x D + CCA + BB + CAAD 1 x D + ACEI + BB + CAAD
D: Diuretic; CCA: Calcium Channel Antagonist; ACEI: Angiotensin-Converting Enzyme Inhibitor; CAAD: Centrally Acting Antihypertensive Drug; BB: Beta-Blocker	

Table 4: Profile of antihypertensive drug regimens prescribed among ambulatory and hospitalized patients with 3 concomitant risk factors in addition to HBP.

≥ 4 risk factors	
Ambulatory patients	Hospitalized patients
Monotherapy	
1 x CCA	1 x CCA 1 x D
Bitherapy	
2 x D + CCA 3 x D + ACEI	3 x D + CCA 1 x CCA + BB 1 x CCA + ACEI 2 x D + CAAD
Tritherapy	
1 x D + 2CAAD 1 x 2D + CCA	3 x D + CCA + ACEI 1 x D + CCA + CAAD 1 x D + ACEI + CAAD
Quadritherapy	
No quadritherapy regimen	1 x D + CCA + ACEI + CAAD 1 x 2D + ACEI + CAAD
D: Diuretic; CCA: Calcium Channel Antagonist; ACEI: Angiotensin-Converting Enzyme Inhibitor; CAAD: Centrally Acting Antihypertensive Drug; BB: Beta-Blocker	

Table 5: Profile of antihypertensive drug regimens prescribed among ambulatory and hospitalized patients with 4 or more concomitant risk factors in addition to HBP.

Ambulatory patients with HBP associated with three modifiable cardiovascular risk factors, received monotherapy or a combination of 2 to 3 antihypertensive drugs while the hospitalized patients received combinations of 2, 3 or 4 antihypertensive drugs. Both groups of patients were placed on bitherapy without diuretic (ACEI + CAAD for outpatients vs CCA + CAAD for inpatients). Moreover, only inpatients received a tritherapy without diuretic (CCA + ACEI + BB). Inpatients were placed on four different quadritherapies including a diuretic of which the most used was the combination made of D + CCA + ACEI + CAAD.

Within the patients with concomitant ≥ 4 modifiable cardiovascular risk factors in addition to HBP, physicians

prescribed mono, bi and tritherapy among outpatients, and those regimens plus quadritherapy among inpatients. Two hospitalized patients received a bitherapy without diuretic (CCA + ACEI or BB). While outpatients were treated with a tritherapy including at least one diuretic made of D + 2CAAD or 2D + CCA, inpatients were treated with a regimen based on tritherapies or quadritherapies with at least one diuretic but the most combinations comprised a CAAD.

Profile of Antihypertensive Drug Regimens Prescribed Among Ambulatory Patients Compared to Hospitalized Patients According to Type and Combinations of Modifiable Risk Factors

Tables 6-8 show the profile of antihypertensive drug regimens prescribed among patients suffering from HBP associated with respectively multiple combinations of modifiable risk factors. Patients with HBP associated with stressful and sendentary lifestyle as cardiovascular modifiable risk factors were placed on mono, bi and tritherapy (outpatients) against mono, bi, tri and quadritherapy (inpatients). A bitherapy without diuretic (CCA + CAAD) was prescribed for one hospitalized patient. Other combinations such as tri or quadritherapy included at least one diuretic.

Stress and sedentary lifestyle	
Ambulatory patients	Hospitalized patients
Monotherapy	
1 x ACEI	1 x CCA
Bitherapy	
2 x D + CCA 3 x D + ACEI	1 x D + ACEI 1 x CCA + CAAD
Tritherapy	
2 x D + CCA + ACEI 2 x 2D + CAAD	1 x D + CCA + ACEI 1 x D + ACEI + CAAD
Quadritherapy	
No quadritherapy regimen	1 x D + CCA + ACEI + CAAD
D: Diuretic; CCA: Calcium Channel Antagonist; ACEI: Angiotensin-Converting Enzyme Inhibitor; CAAD: Centrally Acting Antihypertensive Drug; BB: Beta-Blocker	

Table 6: Profile of antihypertensive drug regimens prescribed among out and inpatients with stressful and sedentary lifestyle as modifiable risk factors in addition to HBP.

Stressful, sedentary lifestyle and obesity	
Ambulatory patients	Hospitalized patients
Monotherapy	
1 x CCA 1 x BB 1 x D	No monotherapy regimen
Bitherapy	
1 x 2D 3 x D + ACEI	3 x D + ACEI 2 x D + CCA
Tritherapy	
2 x D + CCA+ CAAD 1 x D + ACEI + CAAD	1 x D + CCA + CAAD 1 x D + ACEI + CAAD
Quadritherapy	
No quadritherapy regimen	1 x D + CCA + ACEI + CAAD 1 x D + ACEI + BB + CAAD
D: Diuretic; CCA: Calcium Channel Antagonist; ACEI: Angiotensin-Converting Enzyme Inhibitor; CAAD: Centrally Acting Antihypertensive Drug; BB: Beta-Blocker	

Table 7: Profile of antihypertensive drug regimens prescribed among out and inpatients with concomitant high stress, sedentary lifestyle and obesity as modifiable risk factors in addition to HBP.

Chronic ethylism with another risk factor among stressful, sedentary lifestyle, obesity and diabetes	
Ambulatory patients	Hospitalized patients
Monotherapy	
2 x CCA	1 x CCA 1 x ACEI 1 x D
Bitherapy	
1 x 2D ²2 x D + CCA 4 x D + ACEI	4 x D + CCA 2 x D + ACEI 1 x CCA + ACEI 2 x CCA + CAAD
Tritherapy	
1 x D + CCA + CAAD 1 x 2D + CAAD 1 x D + 2CAAD	5 x D + CCA + ACEI 3 x D + CCA + CAAD 1 x D + ACEI + CAAD 1 x CCA + ACEI + CAAD 1 x CCA + ACEI + BB
Quadritherapy	
No quadritherapy regimen	6 x D + CCA + ACEI + CAAD 1 x 2D + ACEI + CAAD 1 x D + CCA + ACEI + BB 1 x D + CCA + BB + CAAD
D: Diuretic; CCA: Calcium Channel Antagonist; ACEI: Angiotensin-Converting Enzyme Inhibitor; CAAD: Centrally Acting Antihypertensive Drug; BB: Beta-Blocker	

Table 8: Profile of antihypertensive drug regimens prescribed among out and inpatients with at least together with chronic ethylism, another risk factor among stressful, sedentary lifestyle, obesity and diabetes as modifiable risk factors in addition to HBP.

The profiles of antihypertensive regimens prescribed among ambulatory patients were mono, bi and tritherapy vs bi, tri and quadritherapy among hospitalized patients, both groups suffering from stressful, sendentary lifestyle and obesity as risk factors in addition to HBP. All other combinations used included at least one diuretic. Six out of ten of them included a CAAD. Regarding modifiable cardiovascular risk factors like at least, together with chronic ethylism, another risk factor among stressful, sedentary lifestyle, obesity and diabetes, outpatients received mono, bi and tritherapy against mono, bi, tri and quadritherapy for inpatients. Moreover, among these latter, three benefited from bitherapy (CCA + CAAD and CCA + ACEI) and two from tritherapy (CCA + ACEI + CAAD or BB) without diuretic. Some of them received four different antihypertensive drug combinations all including at least one diuretic of which the combination of D + CCA + ACEI + CAAD was the most prescribed as in case of inpatients with tree risk factors.

Discussion

The prevalence of modifiable risk factor number in a hypertensive patient according to his statute (out or inpatient) is not available within Togolese population but considering the whole cohort with HBP, more than three out of four subjects have at least one other cardiovascular risk factor [7]. Due to the paucity of literature related to this topic (prevalence of modifiable risk factor combination among hypertensive outpatient versus inpatient) within the Togolese population, our findings could not be compared. However, considering these risk factors individually, Baragou et al. reported modifiable cardiovascular risk factors of stress (43%), sedentary lifestyle (41%), obesity (25.2%), alcohol use (11%) and diabetes (7.3%) among adult population in an urban area of Lomé (Togo) [8] of whom our population study is issued. These are various and important risk factors to fight in order to reduce the risk for HBP.

Concerning SBP/DBP control among patients treated with different antihypertensive regimens, SBP was significantly reduced in patients with 3 risk factors and DBP in patients with at least, together with chronic ethylism, another risk factor among stressful, sedentary lifestyle, obesity and diabetes. Excluding CAAD, our findings are in accordance with the guidelines from European Society of Hypertension (ESH)/European Society of Cardiology (ESC) who reported that D, CCA and ACEI are included among pharmacological groups recommended as suitable for initiation and maintenance of antihypertensive treatment either as monotherapy or in suitable combinations [9].

The combination made of D + CCA + ACEI + CAAD is supported by the differences between the pharmacological classes with respect to target-organ damage and prevention of cardiovascular events. So the treatment should be individualized according to concomitant risk factors and diseases, and depend on age, biochemical and hemodynamic measurements [10]. Indeed, the combination including CCA + ACEI is classified as first intention combination because of its fully additive BP reduction [10-13]. Besides, the benefit of this combination is highlighted through its cardioprotective, vasculoprotective and renoprotective effects, in part mediated through a reduction in oxidative stress, a decreased interstitial fibrosis, cell migration and growth, and the prevention of endothelial dysfunction. Some antihypertensive agents may indeed produce drug-specific benefits beyond BP lowering [14,15].

Among patients with HBP associated with at least, together with chronic ethylism, another risk factor among stressful, sendentary lifestyle, obesity and diabetes, the number of antihypertensive drug combinations prescribed were higher among inpatients: 13 different combinations against 6 for outpatients. This result could be explained by the severity and the complication conditions among these patients (multiple risk factor, diabetes which places hypertensive patients automatically in the highest risk category because of the enhancement of vascular and renal injury and its consequences [16-18], resistance to antihypertensive treatment) indicating that the use of a combination should be the first-line treatment.

Our study showed that prescribers resorted also to monotherapy to treat patients with multiple cardiovascular risk factors, but more among outpatients than inpatients. Besides, when that regimen is sufficient to control BP, they preferred CCA whatever the patient's status certainly because of some of its advantages (effectiveness notably in the black race patients [19], no adverse effects on lipid or carbohydrate, well tolerated notably in diabetic patients [10]). Among CCA group, lercanidipine, a lipophilic agent with a long receptor half-life [20] exhibited some advantages in various clinical studies: effective in elderly and younger patients with concomitant disease or risk factors such as obesity [21], diabetes mellitus [21,22], reduction in insulin resistance [23], across all risk levels and most effective in those with the highest risk [24]. However, Tonje et al. [10] reported that a blocker of renin angiotensin system (ACEI) should be preferred when monotherapy is sufficient.

Our study also highlights the place of CAAD (Central Adrenolytic Agents) in the management of complicated HBP (associated with multiple modifiable cardiovascular risk factors) in an African context. Indeed, outpatients with 3 risk factors and inpatients with high stress, sedentary lifestyle and obesity were placed on 2/3 combinations including CAAD. Our results show that this class of drug has its place in the management of HBP, in contrast with data from developed countries where its place is

reduced. In these countries, BB, another adrenolytic agent has an important place in the management of HBP [5,10] whereas their use is limited in Togolese, and even more generally in an African context. Regarding our study context, prescribers should consider the fact that BB increase the risk of developing new-onset diabetes mellitus, particularly when combined with thiazide diuretics [25]. That class of diuretic in high doses may worsen glycemic control by impairing insulin secretion and decreasing peripheral insulin sensitivity [10]. The metabolic adverse effects of BB are not seen with vasodilating noncardioselective third-generation BB such as carvedilol, a lipophilic and non-intrinsic sympathomimetic agent [26,27] which exhibits favorable effects on metabolic parameters, eg, glycemic control, insulin sensitivity [28,29], and decrease low-density lipoprotein cholesterol [30,31], suggesting that it could be considered in the treatment of patients with metabolic syndrome or diabetes [32]. Finally, while the guidelines from ESH/ESC recommended D, BB, CCA, ACEI and ARB for initiation and maintenance of antihypertensive treatment, either as monotherapy or in suitable combinations [9], the profile of suitable classes of this study includes D, CCA, ACEI as first choice in monotherapy or in addition to CAAD in suitable combinations.

Conclusions

The results of the present study indicate that antihypertensive drug regimens including mono to quadruple therapy reduced significantly SBP in patients with 3 concomitant modifiable risk factors and DBP among patients with at least, together with chronic ethylism, another risk factor among stress, sedentarity, obesity and diabetes. Regarding antihypertensive regimen profiles, monotherapy was used to treat outpatients more than inpatients. Besides, when this regimen is sufficient to control BP, prescribers preferred CCA whatever the patient's status (out or inpatient). This study also allowed us to highlight the place of CAAD in the management of complicated HBP associated with multiple modifiable cardiovascular risk factors in our context. Indeed, among outpatients with 3 risk factors against inpatients with high stress, sendentary lifestyle and obesity; D, CCA, and ACEI were prescribed as first choice antihypertensive drugs for the initiation and maintenance of antihypertensive treatment either as monotherapy or in addition to CAAD in suitable combinations in two out of tree of total combinations prescribed. Additional studies including a more important number of patients are needed to elucidate the relation between number, type and combinations of modifiable cardiovascular risk factors associated to HBP and antihypertensive drug regimens.

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Conflict of Interest Declaration

The authors have no conflict of interest (patent or stock ownership, membership of a company board of directors, membership of an advisory board or committee for a company, and consultancy for or receipt of speaker's fees from a company) to declare.

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