

Diuretic Use in Black Patients With Uncontrolled Hypertension

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BACKGROUND

Highly publicized recommendations favor the use of diuretics as a first-line or add-on agent in the management of hypertension, particularly among black patients and patients with resistant hypertension. Failure to follow such guidelines might contribute to high rates of uncontrolled hypertension. This study assessed diuretic prescribing patterns in a sample of black patients with uncontrolled hypertension who were identified from a population of home care recipients.

METHODS

The study was conducted in an urban home health organization. Participants were black, aged 21 to 80 years, and had a diagnosis of hypertension. Participants with uncontrolled hypertension were identified, and in-home interviewers collected information on prescribed antihypertensive medications.

RESULTS

Of 658 participants, 5.5% were not prescribed any antihypertensives, and only 46% were prescribed a diuretic. Participants who were not

taking a diuretic were taking fewer antihypertensive medications (1.7 vs. 2.9; $P < 0.0001$), had a higher mean diastolic blood pressure (89.2 vs. 85.5; $P = 0.0005$), and were more likely to have a systolic blood pressure ≥ 160 mm Hg (57.6% vs. 49.0%; $P = 0.04$). The adjusted mean systolic and diastolic blood pressures were 5 and 4 mm Hg lower, respectively, in patients who were taking a diuretic.

CONCLUSIONS

In this sample of black patients with uncontrolled hypertension, despite wide publicizing of the recommendations for use of diuretics, a majority are still not receiving a diuretic. This important issue merits continued attention.

Keywords: African Americans; antihypertensive medication; blood pressure; diuretics; hypertension.

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Hypertension is a key risk factor for cardiovascular disease, yet treatment control rates in the United States are suboptimal. Racial disparities continue to exist, with hypertension having a greater effect in blacks with regard to prevalence, severity, organ damage, and mortality.¹⁻³ Among hypertensive non-Hispanic blacks, rates of uncontrolled hypertension remain high, at 64.2% of men and 51.8% of women.⁴ Despite the reported efficacy for use of thiazide diuretics and potassium-sparing diuretics in blacks,^{5,6} a recent study of treated black patients in an ambulatory clinic found that only 39% of patients reported taking a diuretic.⁷

Several large trials have reported that the cardiovascular outcome after treatment with “newer” classes of agents (angiotensin-converting enzyme inhibitors (ACEIs), angiotensin-receptor blockers (ARBs), and calcium channel blockers (CCBs)) is not superior to that after treatment with the “older” diuretic agents.⁸ Furthermore, the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT) reported that in black patients the outcome was

better after treatment with diuretics than after treatment with ACEIs.^{9,10} Consequently, the Seventh Report of the Joint National Committee for Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC7) recommendation of a diuretic as the preferred first-line therapy for hypertension is particularly appropriate for the treatment of black patients.¹¹

Evidence suggests that failure to follow guidelines for blood pressure targets and medication management contributes to high rates of uncontrolled hypertension.^{12,13} This study extends prior observations about the use of diuretics in blacks, examining their use among patients with uncontrolled hypertension drawn from a population of home care recipients.

METHODS

All study procedures and protocols were approved by the appropriate institutional review boards. Details of the study design and recruitment procedures have been published elsewhere.¹⁴

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Study setting and sample

The study was conducted in the post-acute care division of a large urban, Medicare/Medicaid-certified home health organization. Study participants were black, English speaking, and aged 21 to 80 years, with a primary, secondary, or tertiary diagnosis of hypertension (ICD-9-CM 401, 402, 403, or 404) on admission in the electronic health record. Only those with uncontrolled hypertension, defined in this study by home blood pressure readings $\geq 140/90$ mm Hg (or $\geq 130/80$ mm Hg for patients with diabetes) at the time of the study recruitment interview, were included. Lower blood pressure thresholds were used for diabetics in accordance with JNC7 guidelines.¹¹ Patients with a diagnosis of either congestive heart failure or chronic kidney disease (based on self-report or ICD codes), in whom diuretics would be indicated for a diagnosis other than hypertension, were excluded from the sample.

Data and measures

Data were drawn from 2 main sources: mainframe data from the study agency and an in-home interview, conducted by trained interviewers. Comorbid conditions were tabulated from a count of the self-report version of the Charlson Comorbidity Index.¹⁵ Blood pressure measurements were obtained by trained interviewers, after participants were seated for 5 minutes, using a Microlife 3AA1-2 device (Microlife USA, Inc, Clearwater, FL), which uses an oscillometric algorithm validated by using the British Hypertension Society criteria. The monitor was programmed to obtain 3 readings and record the average.

The in-home interviewers recorded information directly from prescription bottles or a medication list that the patient provided, and antihypertensive medications were identified. Components of combination pills were recorded as separate drugs, with the sole exception of the combination containing 25 mg of hydrochlorothiazide with 37.5 mg of triamterene, which was recorded as 25 mg of hydrochlorothiazide only, because of the insignificant antihypertensive effect of 37.5 mg of triamterene.^{16,17}

Statistical methods

Descriptive statistics were summarized for patient characteristics and number of blood pressure medications, with means and SDs for continuous variables and frequencies and/or percentages for categorical variables. Fisher's exact or χ^2 tests were used to evaluate associations between 2 categorical variables, and 2-sample *t* tests were used to compare continuous variables between 2 groups. Multivariate linear regressions were performed to examine the use of diuretics in relation to blood pressure, with adjustment for participant characteristics, number of antihypertensive medications, and comorbid conditions. The coefficient estimates (β), standard errors, and 95% confidence intervals (CIs) were reported. All *P* values are 2 sided, with statistical significance evaluated at the 0.05 α level. All analyses were performed with SAS 9.2 software (SAS Institute, Cary, NC).

RESULTS

Sample characteristics

Table 1 presents selected demographic and clinical characteristics of the study sample. Two-thirds were women; the majority were obese (40%) or overweight (29%). Three of 5 participants had diabetes. Ninety-four percent were taking antihypertensive medications. The mean blood pressure was 155.3/87.4 mm Hg. A significant portion of participants (43%) had Medicaid coverage.

Of the 658 participants, only 300 (46%) were taking a diuretic at the baseline examination, including 30 who were taking >1 diuretic. Among the 300, 68.0% were taking a thiazide diuretic, 33.3% a loop diuretic, and 4.3% a potassium-sparing diuretic (including 3.0% who were taking an aldosterone receptor blocker). The proportion taking diuretics included 32.6% of underweight or normal-weight, 43.1% of overweight, and 55.3% of obese participants. The proportion among diabetics and nondiabetics was 46.9% and 43.8%, respectively.

Participants who were not taking a diuretic, compared with those who were, were also taking fewer antihypertensive medications (1.7 vs. 2.9 medications; $P < 0.0001$). They had a higher mean diastolic blood pressure (89.2 vs. 85.5 mm Hg; $P = 0.0005$), and were more likely to have a systolic blood pressure ≥ 160 mm Hg (57.6% vs. 49.0%; $P = 0.04$).

Diuretic use and blood pressure

Among the 94.5% of participants who were taking antihypertensive medication, 26.5% ($n = 165$) were taking just 1 antihypertensive agent (Table 2), and of these only 12% ($n = 19$) were taking a diuretic. The percentage taking a diuretic increased to 43%, 73%, and 90% among those taking 2, 3, or ≥ 4 medications, respectively.

Multiple regression analysis shows that use of diuretics was associated with lower systolic and diastolic blood pressure (mean systolic change, -5 mm Hg (95% CI, -8.80 to -1.21 ; $P = 0.01$); mean diastolic change, -3.79 mm Hg (95% CI, -6.16 to -1.41 ; $P = 0.002$)) (Table 3) after adjustment for other participant characteristics, including age, sex, body mass index, number of antihypertensive medications, and comorbid conditions. The number of medications taken was significantly positively related ($P = 0.0004$) to the level of systolic blood pressure, but only a nonsignificant trend ($P = 0.07$) was indicated for diastolic blood pressure.

Antihypertensive drug regimen and blood pressure

Table 4 shows the antihypertensive drug regimens of the participants categorized by level of blood pressure. The mean number of medications was marginally greater in patients with a blood pressure $\geq 160/\geq 100$ mm Hg than in those whose blood pressure was 140–159/90–99 mm Hg (2.38 vs. 2.21 medications; $P = 0.06$). Patients whose blood pressure

Table 1. Characteristics of Study Participants, According to Antihypertensive Drug Regimen

Characteristic	Regimen includes a diuretic	Regimen does not include a diuretic	No antihypertensive medication	Total	P value ^a
All patients	300 (45.6%)	322 (48.9%)	36 (5.5%)	658 (100.0%)	
Male	78 (26.0%)	135 (41.9%)	12 (33.3%)	225 (34.2%)	0.0004
Female	222 (74.0%)	187 (58.1%)	27 (66.7%)	433 (65.8%)	
Age <65 years	125 (41.7%)	154 (47.8%)	25 (69.4%)	304 (46.2%)	0.12
Age ≥65 years	175 (58.3%)	168 (52.2%)	11 (30.6%)	354 (53.8%)	
BMI category (kg/m ²)	(n = 286)	(n = 308)	(n = 35)	(n = 629)	
Underweight or normal weight (<25)	57 (19.9%)	105 (34.1%)	13 (37.4%)	175 (27.8%)	<0.0001
Overweight (25–29)	78 (27.3%)	93 (30.2%)	10 (28.6%)	181 (28.8%)	
Obese (≥30)	151 (52.8%)	110 (35.7%)	12 (34.3%)	273 (43.4%)	
No. of comorbid conditions, mean (SD)	2.05 (1.20)	1.92 (1.14)	1.81 (1.24)	1.97 (1.17)	0.17
No diabetes	123 (31.0%)	147 (45.7%)	11 (30.6%)	281 (42.7%)	0.24
Diabetes	177 (69.0%)	175 (54.4%)	25 (69.4%)	377 (57.3%)	
Medicaid enrollee	117 (39.0%)	149 (46.3%)	18 (50.0%)	284 (43.2%)	0.07
No. of antihypertensive medications, mean (SD)	2.9 (1.1)	1.7 (0.8)	0 (0)	2.2 (1.1)	<.0001
Mean SBP (SD) (mm Hg)	154.68 (20.37)	156.33 (19.79)	150.92 (21.55)	155.28 (20.17)	0.31
Mean DBP (SD) (mm Hg)	85.46 (13.82)	89.16 (12.19)	88.06 (12.51)	87.41 (13.08)	0.0005
SBP 140–159 or DBP 90–99 mm Hg (130–149/80–89 mm Hg in diabetics)	153 (51.0%)	137 (42.6%)	19 (52.8%)	309 (47.0%)	0.04 ^b
SBP ≥160 or DBP ≥100 mm Hg (≥150/≥90 mm Hg in diabetics)	147 (49.0%)	185 (57.6%)	17 (47.2%)	349 (53.0%)	

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; SBP, systolic blood pressure.

^aAll P values are based on comparison between patients receiving antihypertensive regimens including or not including a diuretic.

^bP value based on comparison between patients with SBP 140–159 or DBP 90–99 mm Hg (130–149/80–89 mm Hg in diabetics) and those with SBP ≥160 or DBP ≥100 mm Hg (≥150/≥90 mm Hg in diabetics).

Table 2. Use of Diuretics According to Number of Antihypertensive Medications Prescribed

No. of antihypertensive medications ^a	No. of participants	
	Diuretic prescribed	No diuretic prescribed
1 (n = 165)	19 (12%)	146 (88%)
2 (n = 220)	95 (43%)	125 (57%)
3 (n = 157)	114 (73%)	43 (27%)
≥4 (n = 80)	72 (90%)	8 (10%)

^aThirty-six subjects were not taking any antihypertensive medication.

was ≥160/≥100 mm Hg were more likely to be taking an ACEI or an ARB than patients with a systolic blood pressure <160 mm Hg and a diastolic blood pressure <100 mm Hg (70.8% vs. 61.4%, respectively; $P = 0.013$) and less likely to be taking a diuretic (44.3% vs. 52.8%; $P = 0.035$).

DISCUSSION

The main finding in this report is that in a sample of black patients receiving home care, fewer than half of those who had uncontrolled hypertension were taking a diuretic of any kind. This is seen despite (i) JNC7 recommendations favoring

the use of diuretics as a first-line agent, (ii) the many factors that link hypertensive blacks with sodium retention, such as suppressed renin, genetic factors, obesity, reduced potassium intake, and greater responsiveness to diuretics, and (iii) the known efficacy of diuretics in patients with resistant hypertension.^{18,19} Fewer than half of patients who were prescribed 1 or 2 drugs were prescribed a diuretic, indicating that the diuretics are not being chosen as the first or second line of treatment for the majority of patients. Even among those who were prescribed ≥3 drugs, 21.5% were not taking a diuretic.

The study found that, in this sample of black hypertensive patients, blood pressure was lower among patients whose

Table 3. Multivariate Regression Analyses with Systolic and Diastolic Blood Pressure as Dependent Variables

Variables	β	SE	P value	95% CI (β)	
				Lower bound	Upper bound
Dependent variable: SBP (n = 622 ^a)					
Prescribed diuretic	-5.00	1.93	0.01	-8.80	-1.21
No. of antihypertensive medications	3.09	0.86	0.0004	1.40	4.78
No. of comorbid conditions	-1.11	0.77	0.15	-2.62	0.40
Age	0.20	0.08	0.01	0.05	0.36
Female sex	1.40	1.79	0.43	-2.12	4.92
BMI	-0.13	0.11	0.25	-0.34	0.09
Diabetes	0.26	1.80	0.89	-3.27	3.78
Dependent variable: DBP (n = 622 ^a)					
Prescribed diuretic	-3.79	1.21	0.002	-6.16	-1.41
No. of antihypertensive medications	0.99	0.54	0.07	-0.07	2.04
No. of comorbid conditions	-0.20	0.48	0.67	-1.15	0.74
Age	-0.30	0.05	<.0001	-0.40	-0.20
Female sex	-2.82	1.12	0.01	-5.03	-0.62
BMI	-0.07	0.07	0.31	-0.20	0.06
Diabetes	-3.81	1.12	0.0007	-6.02	-1.60

Abbreviations: BMI, body mass index; CI, confidence interval; DBP, diastolic blood pressure; SBP, systolic blood pressure.

^aTwenty-eight subjects had missing values for independent variables.

Table 4. Patients' Antihypertensive Drug Regimen According to Blood Pressure Level

Blood pressure level (mm Hg)	No. of Patients	No. of antihypertensive medications, mean (SD)	Class of medication prescribed, % of patients				
			Diuretic	ACEI or ARB	CCB	β -Blocker	Others
140–159/90–99 (130–149/80–89 in diabetics)	290	2.21 (1.06)	52.8	61.4	43.4	51.4	4.5
$\geq 160/\geq 100$ ($\geq 150/\geq 90$ in diabetics)	332	2.38 (1.15)	44.3	70.8	50.0	50.3	11.8
P value ^a		0.06	0.04	0.01	0.12	0.79	0.001

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin-receptor blocker; CCB, calcium channel blocker.

^aP values are calculated with *t* tests for mean number of medications and χ^2 tests for the drug regimens.

regimen included a diuretic. Their adjusted mean systolic and diastolic blood pressures were 5 and 4 mm Hg lower, respectively, than in patients whose regimen did not include a diuretic.

These findings are particularly striking, because all of the patients assessed in this study were black and had uncontrolled hypertension, in whom a diuretic would almost always be recommended. The finding is even more disturbing given the socioeconomic status of most patients in this study and the low cost of diuretic therapy that could enhance patient adherence. Thus, the absence of a diuretic in the regimen of more than half of the patients in this study is contrary to guidelines and may be harmful to patients, both medically

in terms of uncontrolled hypertension and economically in terms of medication costs and compliance. Although these patients were being served at a single home care agency, the prescribing providers came from a wide variety of service settings.

One could argue that the study findings are possibly mitigated by prescription of a CCB as a valid alternative to a diuretic among patients who were not prescribed a diuretic, given the effectiveness of CCBs in lowering blood pressure in volume-mediated hypertension,^{20,21} and the superiority, in terms of cardiovascular events, of an ACEI-CCB combination over an ACEI-diuretic combination in the ACCOMPLISH trial.²² However, several factors argue

against this explanation. First, the findings at the initial visit antedated the reporting of the ACCOMPLISH trial. Second, even allowing for the use of a CCB as an acceptable alternative to a diuretic, there were still 31.5% of patients who were taking neither a diuretic nor a CCB. Furthermore, in patients in whom a CCB did not control the hypertension, particularly among those prescribed ≥ 3 drugs, there is consensus that a diuretic should be added or substituted.²³

It is unclear why so few patients in this sample had not been prescribed a diuretic. Concern over glucose homeostasis in diabetics could not be an explanation, because diabetics were more, rather than less, likely to be taking a diuretic. Prior intolerance to diuretics is also unlikely, because the rate of discontinuation of diuretics is not high. Furthermore, in patients with a history of adverse reaction to a thiazide diuretic, physicians have the option of prescribing a loop and/or potassium-sparing diuretic instead of a thiazide diuretic.

It is possible that some patients were not given diuretics because of contraindications, such as gout, a history of allergy to drugs such as sulfa antibiotics, or a history of hyponatremia. These constitute relative contraindications, and if a diuretic is truly indicated, as in patients with uncontrolled hypertension, one can be given, though not necessarily a thiazide diuretic. Regardless, these relative contraindications would be unlikely to provide an explanation for the widespread underuse of diuretics reported in this study.

This study has several limitations. It focuses on black patients served by a single urban home health organization. The sample was selected (in response to National Heart Lung Blood Institute (NHLBI) Request for Applications-HL-04-007) to target high blood pressure among blacks, and therefore it did not target blacks with controlled hypertension or members of other racial or ethnic groups with controlled or uncontrolled hypertension. However, it is a strength of the study that it focused on members of an undertreated, understudied population among whom high blood pressure has proved particularly intractable and damaging and in whom guidelines strongly recommend a diuretic as a mainstay of treatment. Nevertheless, because the findings presented are derived from a single cohort, their generalizability may be limited. An additional limitation is that the antihypertensive medication information and the 3 blood pressure readings were collected at a single point in time.

Previous studies that examined the proportion of a population that is taking a diuretic have focused largely on patients whose hypertension is under control. A recent study of treated black patients in an ambulatory clinic found that 39% reported receiving a diuretic.⁷ One would expect that among black patients with uncontrolled hypertension, the proportion prescribed a diuretic would be higher. In this context, the 46% reported in this study has to be considered strikingly low and adds to the evidence that use of diuretics seems to be suboptimal. Consistent with our findings, despite the dissemination of the JNC7 report and the recommendation of the use of thiazide-type diuretics, no increase in prescribing of this class was identified between 2004 and 2008.²⁴

An important aspect of this problem that was not a focus in this study is the dose of the diuretic. A recent meta-analysis by Messerli *et al.* highlighted the lower antihypertensive effect of dosage of hydrochlorothiazide of ≤ 25 mg/d, compared

with monotherapy with agents from other antihypertensive drug classes.²⁵ Furthermore, 25 mg of hydrochlorothiazide is less effective than 25 mg of chlorthalidone, the diuretic regimen used in ALLHAT. In the current study, 67.3% of patients who were taking a diuretic were taking hydrochlorothiazide, and among them, the dose was ≤ 25 mg/d in 93.1%. Only 6.9% were taking a stronger regimen, such as a higher dose, or a combination with a potassium-sparing agent. Thus in this population with uncontrolled hypertension, even when a diuretic was prescribed, the regimen in many cases was inadequate.

In this sample of black patients with uncontrolled hypertension, despite wide publicizing of the recommendations for use of diuretics, many are still not receiving a diuretic. This important issue merits continued attention.

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DISCLOSURE

The authors declared no conflict of interest.

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