Prevalence of Masked Hypertension in African Americans

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Masked hypertension (MH), the presence of normal office blood pressure (BP) with elevated ambulatory pressure, has been shown to correlate with organ damage. Population-based studies from Europe and Asia estimate a prevalence of 8.5% to 15.8%. Two small studies in African Americans estimate a prevalence >40%. Therefore, the authors utilized ambulatory BP monitoring (ABPM) to identify the prevalence of MH in our African American population. Pressure was recorded every 30 minutes while awake and every 60 minutes while asleep. Patients with 24-hour average BP ≥135/85 mm Hg, awake average BP ≥140/90 mm Hg, or asleep average BP ≥125/75 mm Hg had MH. Seventy-three participates had valid data. The mean age of the patients was 49.8 years, mean body mass index was 31.1, and 39 patients (53%) were women. Thirty-three patients (45.2%) had MH. Patients with MH had higher clinic systolic BP and trended toward higher BMI values. The authors corroborated the high prevalence of MH in African Americans. ABPM is critical to diagnose hypertension in African Americans, particularly in those with high-normal clinic pressure and obesity. *J Clin Hypertens (Greenwich).* 2014;16:801–804.

Hypertension has been defined by several medical societies as an in-office systolic blood pressure (SBP) >140 mm Hg or diastolic blood pressure >90 mm Hg.[1,2] Traditionally, hypertension is diagnosed based on office blood pressure (BP) measurements with the average measurement of two or more readings taken at each of three or more visits during a span of weeks to months to represent the actual BP. The development of techniques to measure BP outside the physician's office with either home or 24-hour ambulatory BP monitoring (ABPM) has made BP characterization more complex. Individuals may have sustained hypertension (BP elevated in both settings), sustained normotension (BP controlled in both settings), white-coat hypertension (BP elevated in the office but normal outside of the office), or masked hypertension (BP normal in the office but elevated throughout the day).[3]

The clinical entity "masked hypertension" was first named and described by Pickering and colleagues in 2002.[4] Patients with masked hypertension are at increased risk for adverse cardiovascular events at a level similar to patients with documented hypertension.[5] In fact, 24-hour BPs have been shown to correlate better with end-organ damage than traditional office measurements and better predict progression to end-stage renal disease.[6]

Several population-based studies have reported the prevalence of masked hypertension to be between 8.5% and 15.8%.[7–10] These studies were conducted in European countries and Japan, thus they may not reflect the prevalence of masked hypertension in American populations. One New York study involving employed adults reported a prevalence of 15.2%.[11] Two small studies examining African Americans (n=38 and n=50) reported a prevalence of 46% and 58%.[12,13] In our present study we sought to determine the prevalence of masked hypertension in an African American population attending an urban ambulatory internal medicine clinic in southeast Michigan.

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METHODS

Study Population

We enrolled African Americans aged 18 to 85 years attending a primary care ambulatory internal medicine clinic in southeast Michigan between February 2012 and June 2014. Patients must have had at least two prior clinic visits. Patients had to be normotensive (BP <140/90 mm Hg) based on office BP measurements taken on each of three consecutive office visits prior to enrollment. Patients with a previous diagnosis of hypertension or taking medication that affected BP such as angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, diuretics, calcium channel blockers, α-blockers, or β-blockers were excluded. Demographic and clinical data were collected prospectively. Written informed consent was obtained from all participants before enrollment. The study protocol was approved by the St. John Providence institutional review board.

Study Design

Patients underwent 24-hour ABPM using a noninvasive BP monitor (Oscar 2; SunTech Medical, Morrisville, NC) starting at the time of enrollment. BP was measured every 30 minutes in patients while awake and every 60 minutes while asleep. Patients were

provided a diary to record their activity and emotional status during each measurement. To be included in the analysis each patient had to have at least 80% valid BP measurements. Individual measurements were considered invalid if there was artifact or cuff timeout error. BP recordings were then analyzed using computer analysis software. Mean 24-hour, awake, and asleep BPs were calculated. Patients with average 24-hour BP ≥135/85 mm Hg, awake average ≥140/90 mm Hg, or asleep average ≥125/75 mm Hg were considered to have masked hypertension. Patients found to have masked hypertension were compared with those who were confirmed to have normotension. Statistical tests were performed using SPSS v11.5.1 (IBM, Armonk, NY).

RESULTS

Patient demographics are summarized in Table I. Of 101 patients enrolled, 73 had valid data. The mean age was 49.8 (±13) years, 39 (53%) were women, mean body mass index was 31.1 (±6.6), average sleep duration was 6.25 (±1.5) hours per night, and mean BP measured in the clinic was 120/76 (±10.4/7.3) mm Hg. Overall, there were few medical comorbidities; 3 (4%) had diabetes mellitus, 7 (10%) had dyslipidemia, and 7 (10%) had known obstructive sleep apnea. Sixteen (22%) used tobacco products, 5 (7%) admitted to daily alcohol use, and 4 (5%) admitted to marijuana use. The total population averaged 1.2 (±1.4) fast-food meals per week (range 0–5) and 0.98 (±1.2) cups of coffee per day (range 0–6). In total, 46 (63%) participants knew of a first-degree relative with hypertension.

Masked hypertension was present in 33 (45.2%) patients. Table II compares patients with masked hypertension with those with confirmed normotension. There was no significant difference in age, sex, presence of diabetes mellitus, dyslipidemia, or obstructive sleep apnea; tobacco, alcohol, or coffee use; number of fast-food meals per week; or family history of hypertension. Patients with masked hypertension had a higher average SBP in the clinic (124 mm Hg vs 118 mm Hg, *P*=.02) and tended to have a higher BMI (32.6 vs 29.9, *P*=.10).

Of the patients found to have masked hypertension, 16 (48%) met all criteria (daytime BP ≥140/90 mm Hg, nighttime BP ≥125/75 mm Hg, or 24-hour BP ≥135/85 mm Hg); eight (24%) met two of the criteria, mostly daytime and 24-hour BPs; six (18%) were nondippers, as they met only the nighttime BP; and three (9%) met only the daytime or 24-hour BP criteria (Figure).

TABLE I. Study Demographics

Age,y	49.8 (±13)
Women, No. (%)	39 (53)
Body mass index	31.1 (±6.6)
Clinic pressure,mmHg	120/76 (±10.4/7.3)
Diabetes mellitus, No. (%)	3 (4)
Dyslipidemia, No. (%)	7 (10)
Obstructive sleep apnea, No. (%)	7 (10)
Family history of hypertension, No. (%)	46 (63)
Tobacco use, No. (%)	16 (22)
Daily alcohol use, No. (%)	5 (7)
Marijuana use, No. (%)	4 (5)
Sleep duration, h per night	6.25 (±1.5)
Fast food intake, meals per wk	1.2 (±1.4)
Coffee consumption, cups per d	0.98 (±1.2)

DISCUSSION

In the largest study to date conducted in African Americans, we have identified a prevalence of masked hypertension of 45.2% in our study population. This is significantly higher than what has been identified in prior population-based studies conducted in Europe and Asia (prevalence 8.5%–15.8%). There have been few population-based estimates of masked hypertension conducted in the United States. A study of adult employees conducted in New York reported a prevalence of 15.2%.[11] This high prevalence in African Americans corroborates the findings of two previous small studies (n=38 and n=50) that enrolled only African Americans in Philadelphia.

Patients found to have masked hypertension had significantly higher SBPs than true normotensive patients (mean 124 mm Hg vs 118 mm Hg, *P*=.02), which is consistent with prior reports.[11,14–16] In our study, patients with masked hypertension had, on average, a larger BMI then normotensive patients (32.6 vs 29.9, *P*=.10). While this finding did not reach statistical significance, previous studies have identified an association between obesity and masked hypertension.[15–17] While several studies have identified an association between smoking and/or daily alcohol use and masked hypertension,[18,19] we did not find an association with either. The rate of smoking was higher in our masked hypertension group (27%) than the normotensive group (18%) but this difference did not reach significance (*P*=.32). The overall smoking rate in our study population was 22%, which is slightly higher than the reported national rate of 18%, and likely reflects the local population.[20]

Patients with masked hypertension have been shown to have both a cardiovascular event and mortality rate similar to patients with sustained hypertension.[5,21] The presence of masked hypertension is associated with markers of impaired vasodilatation and endothelial dysfunction, which are early manifestations of coronary artery disease.[22,23] Thus, if our findings are representative of the general African American population, then nearly half of the African Americans who are believed to not have hypertension by office-based measurements actually carry a cardiovascular risk comparable to those with sustained hypertension. These patients can only be identified by obtaining out-of-office BP measures with ambulatory or home BP monitoring. Additionally, only ambulatory monitoring will identify patients with isolated nocturnal hypertension (nondippers), which accounted for 18% of our masked hypertension population. Screening with ABPM to detect masked hypertension in untreated individuals is supported in European guidelines.[24] In the United States, several

TABLE II. Characteristics of Patients With Masked Hypertension Compared With Those With Confirmed Normotension

	Masked Hypertension (n=33)	Confirmed Normotension (n=40)	*P* Value
Mean clinic systolic pressure, mmHg	124 (±10.2)	118 (±10.5)	.02
Mean clinic diastolic pressure, mmHg	77 (±6.7)	75 (±7.8)	NS
Age, y	50.8 (±12.4)	49.1 (±14.1)	NS
Women, No. (%)	17 (52)	22 (55)	NS
Body mass index	32.6 (±7.7)	29.9 (±5.5)	.10
Diabetes mellitus, No. (%)	1 (3)	2 (5)	NS
Dyslipidemia, No. (%)	5 (15)	2 (5)	NS
Obstructive sleep apnea, No. (%)	4 (12)	3 (8)	NS
Family history of hypertension, No. (%)	20 (61)	26 (65)	NS
Tobacco use, No. (%)	9 (27)	7 (18)	NS
Alcohol use, No. (%)	3 (9)	2 (5)	NS
Coffee consumption	1.20 (±1.2)	0.81 (±1.0)	NS
Fast food intake, meals per wk	1.1 (±1.3)	1.3 (±1.4)	NS

Abbreviation: NS, not significant.

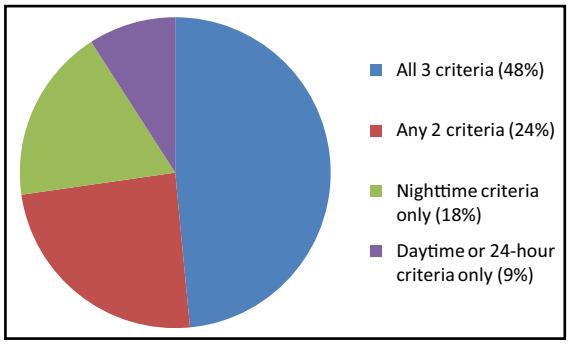

FIGURE. Distribution of ambulatory blood pressure criteria met by patients with masked hypertension.

professional societies have advocated for increased use and reimbursement for ABPM, although not specifically for the detection of masked hypertension.[25]

There is currently a lack of evidence on the best approach for detecting masked hypertension. Certainly, patients with end-organ damage (eg, left ventricular hypertrophy and proteinuria) should be screened with 24-hour ABPM. Ideally, these patients should be identified and treated before the development of organ damage. Patients with risk factors (eg, high-normal SBP, obesity, smokers) should be screened, as suggested by Peacock and colleagues.[26] In that case, a majority of patients would qualify for screening yet we would still potentially miss many patients who truly have masked hypertension. If 45% of African Americans truly have masked hypertension, the case can be made for universal screening with ABPM in this population.

There is also a paucity of evidence to guide therapy in patients with masked hypertension. Given that these patients are at increased risk for progression to sustained hypertension,[27] one approach is to closely monitor these individuals and treat once overt hypertension develops. An alternate approach would be to lower the ambulatory pressure and monitor with serial ABPM studies. Currently, we lack evidence to demonstrate that active treatment of masked hypertension improves outcomes. To date, we are not aware of any randomized trials evaluating the treatment outcomes in patients with masked hypertension.

STUDY LIMITATIONS

We recognize several limitations to our current study. Our population was derived from an established clinic population and thus may not reflect the general population as a whole. Additionally, these findings need to be confirmed in other geographic regions across the country. We need multicenter population-based studies. It is notable that our cutoff values for diagnosing masked hypertension are slightly higher (about 5 mm Hg) than the most recent recommendations.[4] Using the lower threshold, we would reclassify six patients from normotension to masked hypertension. Therefore, it is possible that despite how common masked hypertension was in our population, we may have underestimated the true prevalence.

CONCLUSIONS

We identified masked hypertension in 45.2% of African Americans enrolled in our ambulatory internal medicine clinic. These results need to be confirmed with population-based studies. Further research is needed to determine the role of treatment to protect this population, which has been shown to be at increased cardiovascular risk.

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