A Trial of 2 Strategies to Reduce Nocturnal Blood Pressure in Blacks With Chronic Kidney Disease


Abstract—The objective of our study was to determine the effects of 2 antihypertensive drug dose schedules (PM dose and add-on dose) on nocturnal blood pressure (BP) in comparison with usual therapy (AM dose) in blacks with hypertensive chronic kidney disease and controlled office BP. In a 3-period, crossover trial, former participants of the African American Study of Kidney Disease were assigned to receive the following 3 regimens, each lasting 6 weeks, presented in random order: AM dose (once-daily antihypertensive medications taken in the morning), PM dose (once-daily antihypertensives taken at bedtime), and add-on dose (once-daily antihypertensives taken in the morning and an additional antihypertensive medication before bedtime [diltiazem 60–120 mg, hydralazine 25 mg, or additional ramipril 5 mg]). Ambulatory BP monitoring was performed at the end of each period. The primary outcome was nocturnal systolic BP. Mean age of the study population (n=147) was 65.4 years, 64% were men, and mean estimated glomerular filtration rate was 44.9 mL/min per 1.73 m². At the end of each period, mean (SE) nocturnal systolic BP was 125.6 (1.2) mm Hg in the AM dose, 123.9 (1.2) mm Hg in the PM dose, and 123.5 (1.2) mm Hg in the add-on dose. None of the pairwise differences in nocturnal, 24-hour, and daytime systolic BP was statistically significant. Among blacks with hypertensive chronic kidney disease, neither PM (bedtime) dosing of once-daily antihypertensive nor the addition of drugs taken at bedtime significantly reduced nocturnal BP compared with morning dosing of antihypertensive medications.  (Hypertension. 2013;61:000-000.) ● Online Data Supplement

Key Words: nocturnal blood pressure ■ chronic kidney disease ■ hypertension

Chronic kidney disease (CKD) is a global public health problem.1 The burden of end-stage renal disease (ESRD) is substantial in many industrialized countries, despite the widespread use of interventions that might slow the progression of CKD, including control of blood pressure (BP) and the use of antihypertensive drugs that inhibit the renin-angiotensin system.2 The limitations of these 2 treatment strategies were recently described among blacks with hypertension-related CKD who participated in the trial and cohort phases of the African American Study of Kidney (AASK) Disease. In these long-term studies, a majority of participants experienced a doubling of serum creatinine, ESRD, or death, despite good office BP control and use of renin-angiotensin system blockers.3 This finding suggests that there are other risk factors that influence loss of kidney function.5

One potential risk factor that has received increasing attention is the lack of diurnal variation in level of BP often observed in people with CKD.4 Among AASK cohort Study participants, 80% either did not show a nocturnal decline in BP (nondipper) or had a higher BP at night than during the day (reverse dipper).7 Previous observational studies have found an association between elevated nocturnal BP and hard outcomes, such as death and cardiovascular disease among people with high BP in the general population.6–10 Studies of the effect of nocturnal BP among people with CKD, although less common and smaller in size, have also shown a direct relationship with progression to ESRD.11–13 These findings suggest that lowering nocturnal BP may reduce morbidity and mortality. An important issue that must be addressed before embarking on a major trial of nocturnal BP reduction on
clinical outcomes in CKD patients is whether nocturnal BP can be lowered.14-18 In this context, we tested 2 approaches to lower nocturnal BP in blacks with hypertensive CKD and controlled office BP.

Methods
We recruited former participants of the AASK cohort study.19 The protocol for this study was approved by the institutional review board at each site, and all participants provided written informed consent. AASK cohort study participants were eligible for the nocturnal BP-lowering study if during the course of the cohort study they had completed a technically acceptable session of ambulatory BP monitoring at the last study visit, attended ≥2 in-clinic visits within the past 12 months, and had average office BP ≤140/90 mm Hg based on the most recent ≥2 BP values measured ≤1 week apart. In addition, to facilitate evaluation of the effect of timing of once-daily medications on level of nocturnal BP, candidates for this study had to be prescribed antihypertensive drug therapy at the baseline visit as follows: (1) 1 antihypertensive medication had to be a once-daily medication; (2) for those prescribed 2 antihypertensive medications, ≥1 had to be a once-daily medication; and (3) for people prescribed ≥3 antihypertensive medications, ≥2 had to be once-daily medication. A 4-week period was established for investigators to change the participants' antihypertensive medications to meet the above eligibility requirements.

AASK cohort study participants were excluded from the nocturnal BP study if they (1) had an arm circumference >50 cm, (2) had reached ESRD and required renal replacement therapy or received a kidney transplant, (3) were currently institutionalized, (4) were shift workers and worked at night, (5) reported a myocardial infarction or cerebrovascular accident that occurred within 3 months of AASK cohort close-out visit, (6) had a known ejection fraction <40%, (7) were pregnant or lactating, or (8) in the opinion of the investigators, were not likely to reach ESRD within the next 6 months.

We conducted an open-label, randomized, 3-period, crossover trial (Figure) of 3 antihypertensive dosing schedules, each lasting 6 weeks. The sequence of the dosing schedules was randomized. Two strategies of dosing (referred to as PM and add-on as described below) were studied in comparison with the standard dose schedule (AM dose).

AM Dose Schedule
The participant’s antihypertensive regimen at the baseline visit was used as the comparison (or control) regimen. Study participants were instructed to take all of their once-daily medications in the morning.

PM Dose Schedule
Study participants were advised to take all of their once-daily antihypertensive drugs at bedtime.

Add-On Dose Schedule
Participants were instructed to take their once-daily antihypertensive medications in the morning. Study investigators prescribed an additional dose of ramipril, diltiazem, or hydralazine to be taken at bedtime based on the following guidelines: (1) participants prescribed ramipril ≤5 mg received an additional bedtime dose of ramipril (5 mg), (2) participants prescribed β-blockers or resting pulse rate <60 per minute received hydralazine 25 mg at bedtime, and (3) participants not meeting (1) or (2) criteria received diltiazem 60 to 120 mg at bedtime.

In the last week of each 6-week treatment period, a 24-hour session of ambulatory BP monitoring was performed; detailed methodology is available in the online-only Data Supplement. Office BP measurements were performed by trained, certified staff using a Tycos classic handheld aneroid device (Tycos Instruments, Inc, Arden, NC) using recommended techniques.20

Statistical Analyses
Baseline characteristics of the study population were described using means±SD for quantitative variables and frequencies and percents for categorical variables. Antihypertensive medication use at both baseline and follow-up in the study was summarized. Nocturnal systolic BP (SBP) was the prespecified primary outcome. Secondary outcomes were nocturnal diastolic BP (DBP), daytime systolic minus nocturnal SBP, daytime diastolic minus nocturnal DBP, night systolic/day systolic ratio, night diastolic/day diastolic ratio, daytime SBP and DBP, and 24-hour SBP and DBP. In this crossover trial, each study participant served as his/her control. A linear mixed effects model with a random subject effect and fixed effects for period, treatment, and latest nocturnal SBP before study entry was used to relate treatment to nocturnal SBP. Results were expressed as adjusted mean difference (95% CI) between PM dose schedule versus AM dose schedule, and add-on dose schedule compared with AM dose schedule. The possibility of a carryover effect of treatment on nocturnal SBP was examined by testing whether treatment comparisons differed among the 3 periods. Although we did not observe a significant carryover effect, data were analyzed by each period in exploratory analyses. Exploratory subgroup analyses were performed by stratifying study participant according to baseline dipping status, presence of masked hypertension, level of urinary sodium excretion, level of nocturnal BP before study entry, and number of antihypertensive medications. Treatment effects were estimated separately for each subgroup, and treatment-by-subgroup interactions were tested. We present analyses based on the order of treatment actually administered; 2 study participants were treated in different order than their randomized assignment and were included in the per-protocol analysis. Sensitivity analyses based on the randomly assigned treatment (intention to treat) order provided similar results. The primary analysis and secondary analyses are reported, without adjustment for multiple comparisons. Given the number of participants enrolled in the AASK cohort study, we estimated that the number of available participants would be ≥180 patients. At this sample size, assuming hypothesis tests are performed at a 2-sided significance level of 5% without adjustment for multiple comparisons, the minimum detectable treatment effect with 80% power was 4.3 mm Hg for nocturnal SBP and 3.0 mm Hg for the difference between nocturnal and daytime SBP.

Results
Of the 430 potentially eligible participants, 151 were randomized. Four study participants did not have any ambulatory BP monitoring measurements and were not included in the analyses. Participants enrolled in the nocturnal BP study were compared with others in the AASK cohort study who did not participate in the nocturnal BP study; participants who enrolled were similar in age and sex, but had lower mean clinic BP (123/71 versus 131/76 mm Hg; P=0.05) and lower mean serum creatinine (2.03 versus 2.28 mg/dL; P=0.009) compared with AASK cohort study participants who did not enroll in the nocturnal BP study.

The mean age of the study population was 65.4 years (Table 1). All participants were black, 64% were men, with longstanding hypertension (mean of 29.9 years), mean serum creatinine was 2.03 mg/dL, and the mean estimated glomerular filtration rate was 44.9 mL/min per 1.73 m². At

Figure. Study schema; 3-period randomized, crossover design. ABPM indicates ambulatory BP monitoring.
The mean number of antihypertensive medications prescribed at baseline was 4.06±1.43; most of the study participants (83.7%) were prescribed ≥3 drugs. In the PM dose schedule, 1 antihypertensive medication was changed to bedtime dosing in 48.8% of participants, and 2 antihypertensive medications were changed to bedtime dosing in 47.6% of participants. In participants where 1 antihypertensive medication was changed to bedtime dosing, the medication was an angiotensin-converting enzyme inhibitor in 72.5%, angiotensin receptor blocker in 15%, and a calcium channel blocker in 12.5%. In the add-on dose schedule, the most common medication added at bedtime was hydralazine in 49.5%, diltiazem in 18.1%, ramipril in 7.6%, and another medication in 24.8% of participants.

Eleven participants did not complete the study; the reasons for not completing the study were low BP based on the clinical determination of the site investigator (n=4), hospitalization not related to the study (n=3), hospitalization for a fall during the usual dosing phase (n=1, reported as possibly study related), participant request (n=1), high BP (n=1), and medical condition other than hypertension (n=1).

Mean (SE) nocturnal SBP was 125.5 (1.2) mm Hg in the AM dose schedule, 123.8 (1.2) mm Hg in the PM dose schedule, and 123.5 (1.2) mm Hg during the add-on dose schedule. Although nocturnal SBP was lower with the PM dose schedule compared with the AM dose schedule (mean nighttime SBP in the PM phase minus mean nighttime SBP in the AM phase was −1.7 mm Hg [95% CI, −4.05 to 0.65]), this difference was not statistically significant (P=0.15; Table 2).

Nocturnal SBP was nonsignificantly lower with add-on dosing compared with AM dosing; mean nighttime SBP in the add-on phase minus mean nighttime SBP in the AM phase was −2.07 mm Hg (95% CI, −4.40 to 0.26; P=0.08). Compared with the AM dose schedule, 24-hour and daytime
SBP, and 24-hour, daytime, and nighttime DBP were not statistically significantly reduced with PM dose schedule or the add-on dose schedule. The difference between daytime and nighttime SBP was 3.25 mm Hg (95% CI, 1.42–5.08; P=0.001) higher, and night/day SBP ratio was 0.02 (95% CI, −0.04 to −0.01) lower in the PM compared with the AM dosing.

In participants receiving hydralazine as the add-on agent, the mean nocturnal SBP was lower in the PM add-on schedule compared with the AM schedule; mean nighttime SBP in the add-on phase minus mean nighttime SBP in the AM phase was −5.32 mm Hg (95% CI, −9.37 to −1.28; P=0.01). In participants on medications other than hydralazine as the add-on agent, mean nighttime SBP in the add-on phase minus mean nighttime SBP in the AM phase was 0.80 mm Hg (95% CI, −2.92 to 4.53; P=0.67). However, a test for interaction between treatment effect and choice of add-on medication was not statistically significant.

Tests for interaction with dose schedule were not statistically significant for subgroups stratified by dipping status, presence of masked hypertension, urinary sodium excretion, nocturnal BP before study entry, and number of antihypertensive medications at baseline (Table 3). In participants with lower urinary sodium excretion, mean nocturnal SBP in the add-on dosing was −4.13 mm Hg (95% CI, −7.68 to −0.58; P=0.02) lower than AM dosing. However, given the multiple statistical tests performed and post hoc nature of these analyses, these findings should be interpreted with caution.

Although comparisons between randomized treatment groups did not significantly differ for lowering of nocturnal BP between the 3 periods, data were analyzed by period in exploratory analyses. Within period 1, nocturnal SBP was −5.73 mm Hg lower in the PM compared with the AM phase (95% CI, −10.6 to −0.89; P=0.02). There were no statistically significant differences in nocturnal SBP between the PM and AM dosing in periods 2 (−2.7 mm Hg; P=0.36) and 3 (2.8 mm Hg; P=0.36). For period 1, there were no statistically significant differences in baseline characteristics between participants assigned to AM, PM, or add-on dosing (data not shown).

**Discussion**

Among blacks with hypertensive CKD and controlled clinic BP, administration of antihypertensives in the evening (PM dose schedule) or by an additional bedtime dose (add-on dosing) resulted in a modest, nonsignificant lowering of nocturnal BP compared with the AM dose schedule. Nocturnal BP is a robust predictor of increased risk of cardiovascular events and mortality.9,10,21–24 Patients with CKD often have elevated nocturnal BP that is associated with more microalbuminuria and progression of kidney disease.12,13,25 In the AASK cohort study, 80% of patients had a nondipping or reverse dipping BP profile; elevated nocturnal BP was associated with increased left ventricular hypertrophy and albuminuria and higher risk of CKD progression.26 Other studies have also documented that nondipping of BP is an independent predictor for ESRD.11,28

Given these observational data, some have hypothesized a benefit of modifying the timing of antihypertensive drug therapy to lower nocturnal BP and restore normal circadian

**Table 3. Post Hoc Subgroup Analyses of Effects of the 2 Regimens on Nocturnal Systolic Blood Pressure**

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>AM</th>
<th>PM</th>
<th>Add-on</th>
<th>Mean (95% CI)</th>
<th>P Value</th>
<th>Mean (95% CI)</th>
<th>P Value</th>
<th>Interaction P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dipping status</strong>*</td>
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<tr>
<td>Dipper</td>
<td>120.3 (2.5)</td>
<td>118.5 (2.58)</td>
<td>119.2 (2.53)</td>
<td>−1.79 (−7.34 to 3.76)</td>
<td>0.52</td>
<td>−1.14 (−6.54 to 4.25)</td>
<td>0.67</td>
<td>0.96</td>
</tr>
<tr>
<td>Nondipper</td>
<td>124.2 (1.63)</td>
<td>121.5 (1.60)</td>
<td>121.3 (1.58)</td>
<td>−2.74 (−6.22 to 0.75)</td>
<td>0.12</td>
<td>−2.99 (−6.40 to 0.42)</td>
<td>0.09</td>
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<tr>
<td>Reverse dipper</td>
<td>132.6 (2.19)</td>
<td>131.4 (2.19)</td>
<td>130.5 (2.17)</td>
<td>−1.23 (−5.57 to 3.10)</td>
<td>0.57</td>
<td>−2.10 (−6.30 to 2.09)</td>
<td>0.32</td>
<td></td>
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<tr>
<td>Nocturnal SBP before study entry (median 123 mm Hg)</td>
<td></td>
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<tr>
<td>Below median</td>
<td>118.3 (1.56)</td>
<td>116.9 (1.55)</td>
<td>116.5 (1.56)</td>
<td>−1.50 (−4.54 to 1.55)</td>
<td>0.33</td>
<td>−1.87 (−4.92 to 1.18)</td>
<td>0.23</td>
<td>0.95</td>
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<tr>
<td>Above median</td>
<td>133.0 (1.73)</td>
<td>130.9 (1.73)</td>
<td>130.2 (1.70)</td>
<td>−2.11 (−5.73 to 1.52)</td>
<td>0.25</td>
<td>−2.79 (−6.37 to 0.79)</td>
<td>0.13</td>
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<tr>
<td>Masked hypertension before study entry</td>
<td></td>
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<tr>
<td>Masked hypertension present</td>
<td>131.6 (1.73)</td>
<td>129.4 (1.71)</td>
<td>129.1 (1.70)</td>
<td>−2.24 (−6.20 to 1.71)</td>
<td>0.26</td>
<td>−2.56 (−6.49 to 1.37)</td>
<td>0.20</td>
<td>0.95</td>
</tr>
<tr>
<td>Masked hypertension not present</td>
<td>121.0 (1.58)</td>
<td>119.7 (1.59)</td>
<td>119.0 (1.58)</td>
<td>−1.27 (−4.14 to 1.60)</td>
<td>0.38</td>
<td>−2.03 (−4.87 to 0.82)</td>
<td>0.16</td>
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<tr>
<td>No. of antihypertensive medications at baseline</td>
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<tr>
<td>1 or 2</td>
<td>121.3 (2.80)</td>
<td>120.5 (2.81)</td>
<td>120.0 (2.71)</td>
<td>−0.82 (−6.60 to 4.96)</td>
<td>0.78</td>
<td>−1.34 (−6.36 to 3.68)</td>
<td>0.59</td>
<td>0.99</td>
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<tr>
<td>3+</td>
<td>126.3 (1.29)</td>
<td>124.6 (1.29)</td>
<td>124.2 (1.28)</td>
<td>−1.76 (−4.42 to 0.89)</td>
<td>0.19</td>
<td>−2.14 (−4.77 to 0.49)</td>
<td>0.11</td>
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<tr>
<td>24-h urinary sodium excretion (median Na/K ratio 2.14)</td>
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<tr>
<td>Above median</td>
<td>124.23 (1.89)</td>
<td>123.44 (1.86)</td>
<td>122.70 (1.86)</td>
<td>−0.79 (−4.19 to 2.60)</td>
<td>0.64</td>
<td>−1.53 (−4.90 to 1.84)</td>
<td>0.37</td>
<td>0.51</td>
</tr>
<tr>
<td>Below median</td>
<td>128.09 (1.70)</td>
<td>125.49 (1.70)</td>
<td>124.75 (1.70)</td>
<td>−3.40 (−6.99 to 0.19)</td>
<td>0.063</td>
<td>−4.13 (−7.68 to −0.58)</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

**AM** dose schedule: study participants were instructed to take all their once-daily medications in the morning. **PM** dose schedule: study participants were advised to take all their once-daily antihypertensive drugs at bedtime. **Add-on** dose schedule: participants were instructed to take their once-daily antihypertensive medications in the morning. Study investigators prescribed an additional dose of ramipril, diltiazem, or hydralazine to be taken at bedtime. SBP indicates systolic blood pressure.
rhythm of BP. In patients with primary hypertension, several studies have reported that altering timing of administration of antihypertensive medication is associated with reduction in nocturnal BP and change in the diurnal BP profile. The Ambulatory BP Monitoring in the Prediction of Cardiovascular Events and Effects of Chronotherapy (MAPEC) study demonstrated that patients taking ≥1 BP-lowering medications at bedtime had a lower risk of cardiovascular disease events than those ingesting all medications upon awakening. Data on patients with CKD are more limited. In an uncontrolled 8-week study, Minutolo et al demonstrated that with administration of antihypertensive medications at night, night/day ratio of mean ambulatory blood pressure decreased in 93.7% of patients, with normal circadian rhythm restored in 87.5%. Interestingly, proteinuria was also reduced with evening administration of antihypertensive drugs. The reduction of cardiovascular risk seen in the MAPEC study was consistent in the CKD subgroup; in 661 patients with CKD, patients who took ≤1 BP-lowering medication at bedtime had lower sleep time BP and a lower adjusted risk for total cardiovascular events (adjusted heart rate, 0.31; P<0.001).

However, information about drug doses was not provided, and the racial/ethnic composition was different compared with this study. Our study evaluated the effects of 2 treatment strategies in lowering nocturnal BP in the setting of CKD. One approach was to administer antihypertensive medications at bedtime (PM dosing), and the other was to continue AM administration of medications but to add an antihypertensive medication at bedtime (add-on dosing). Both strategies showed only modest effects on nocturnal BP, effects that were not statistically significant compared with morning dosing. Secondary outcomes such as the night/day ratio were lower, and the daytime-night BP was higher in the PM compared with the standard group, reflecting modification in the diurnal variation in BP. In exploratory analyses, these findings were consistent in subgroups defined by dipping status, nocturnal BP, urinary sodium excretion, and number of antihypertensive medications at baseline. In the PM add-on dose schedule, hydralazine administration was associated with reduction in nocturnal BP. However, this was a post hoc analysis, and the test of interaction was not significant; therefore, this finding should be interpreted with caution. In comparing these results with the study by Minutolo et al, the patient populations between the 2 studies were quite different with regard to ethnicity and duration of hypertension. In addition, in the Minutolo study there was no control group to fully evaluate the effect of the intervention.

Our findings suggest that approaches to reduce the level of nocturnal BP and restore diurnal rhythm of BP in people with CKD require further study. Several factors may be responsible for the lack of significant nocturnal BP lowering we observed. The dose of the add-on agents used in this study was relatively low; increasing the dose used in the add-on strategy may be one area to explore in future trials, particularly in patients with CKD or populations with more resistant hypertension. In addition, our interventions did not address sleep abnormalities that are commonly present in patients with CKD and that may contribute to persistent elevation of BP at night. There are also data to suggest that elevated nocturnal BP may relate to salt sensitivity of BP, with higher BP at night reflecting a pressure natriuresis as a result of decreased sodium excretion during the day. This suggests that perhaps optimization of salt and water balance with appropriately timed diuretic therapy may be helpful in maintaining the diurnal profile of BP. In any case, interventions that consistently lower nocturnal BP need to be developed and tested before the implementation of a prospective trial that evaluates the impact of nocturnal pressure reduction in CKD on clinical outcomes.

This study has several strengths, making an important contribution to this field. The patient population was well defined, and interventions were practical to implement in daily practice. Measurement of BP both in the clinic and ambulatory setting was done by trained staff using standard protocols. However, there also some important limitations to be considered in the interpretation and extrapolation of these results. All patients were blacks with hypertensive CKD and had relatively well-controlled BP; therefore, whether similar results would be seen in patients of other race/ethnicity, cause of CKD, or higher BP remains uncertain. The projected sample size was not achieved with some loss of power to detect a difference between the interventions. Accordingly, as reflected in the lower limits of the 95% CIs for the treatment effects on nocturnal BP (~4.05 mm Hg for PM versus AM dosing and ~4.40 mm Hg for add-on versus AM dosing), we are unable to rule out undetected moderate reductions of nighttime SBP of up to ~4 mm Hg by the 2 nocturnal dosing strategies. The smaller sample size in this study (n=147), compared with the larger MAPEC study (n=2156 overall and 661 with CKD), may limit our ability to detect significant differences.

Finally, there was no washout period between the interventions, although the 6-week duration makes it unlikely that there would be significant residual effect.

In summary, among blacks with hypertensive CKD, PM dosing of once-daily antihypertensive medications and the administration of an add-on drug at bedtime after AM administration of once-daily medications were safe and had modest, nonsignificant effects on nocturnal BP.

Perspective

In observational studies, elevated nighttime BP is associated with increased risk of adverse kidney and cardiovascular outcomes in the general population and in patients with CKD. Antihypertensive drug therapy lowers clinic BP, but little is known about how to reduce nighttime BP. We tested 2 practical strategies, each designed to lower nocturnal BP. One strategy switched antihypertensive medications from morning to bedtime dosing. A second strategy added a bedtime dose of an antihypertensive medication. We tested these strategies in blacks with hypertension-related CKD, a condition associated with high levels of nighttime BP. However, neither of the strategies lowered nighttime BP. Additional research is needed to develop and test strategies that lower nighttime BP.
Sources of Funding

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Disclosures

Dr Rahnman has research support from National Institutes of Health (NIH) and has received honoraria from Boehringer Ingelheim. Dr Bakris has served as a consultant/advisory board for Takeda, Servier, Abbott, CVRx, Johnson and Johnson, Eli Lilly, and Medtronic. Dr Jamerson has research grant support from NIH, National Institute of Diabetes, Digestive and Kidney Diseases, and National Heart, Lung, and Blood Institute, serves on the speakers bureau for Daichi-Sankyo pharmaceuticals, has received honoraria from Boehringer-Ingelheim, Daichi-Sankyo, Forest, Novartis, and Xuma Pharm, and served as a consultant/advisory board for Boehringer-Ingelheim, Daichi-Sankyo, Forest, Pfizer, Novartis, Xuma pharm, and Invasc Therapeutics. Dr Rostand holds shares of common stock in Merck. Dr Toto has served on the speakers bureau for Amgen and Merck and has served as consultant/advisory board for Boehringer-Ingelheim and Amgen. Dr Wright has served as consultant/advisory board for Medtronic, Takeda, and Medical Letter. The other authors have no conflicts to report.

References

What Is New?
This study shows that in blacks with hypertensive chronic kidney disease, neither PM (bedtime) dosing of once-daily antihypertensive nor the addition of drugs taken at bedtime significantly reduced nocturnal blood pressure compared with morning dosing of antihypertensive medications.

What Is relevant?
There is increasing interest in a nighttime blood pressure as a risk factor for long-term outcomes.

Summary
Nocturnal blood pressure is well known as risk factor for renal and cardiovascular outcomes. This is one of the first studies to evaluate whether nocturnal blood pressure can be lowered by simple changes in antihypertensive drug therapy in patients with chronic kidney disease.
A Trial of 2 Strategies to Reduce Nocturnal Blood Pressure in Blacks With Chronic Kidney Disease


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**Title:**

A TRIAL OF TWO STRATEGIES TO REDUCE NOCTURNAL BLOOD PRESSURE IN AFRICAN AMERICANS WITH CHRONIC KIDNEY DISEASE

**Authors names**

ABPM methods

SpaceLabs Medical Model 90217 was used. ABP monitor Arm circumference was measured to ensure use of appropriate size cuff. The monitor recorded BP every 30 minutes. Written instructions for use of the device were provided to participants. Study participants also recorded in a diary the time they went to bed, the time they awoke, nap time during the course of the day, and the time they took their antihypertensive medication(s). The ABPM session was considered adequate if the device had been worn for a continuous 24 hour period and resulted in at least 14 acceptable readings between 6:00 a.m. and 12:00 a.m., and 7 acceptable readings between midnight to 6:00 a.m. Night was defined as the period of time from midnight to 6 AM, and day was defined as the period of time from 6 AM to midnight. Nondipping was defined by a ≤ 10% decrease in mean nighttime systolic BP; reverse dipping was defined by a higher nighttime than daytime systolic BP. Masked hypertension was defined as both daytime systolic blood pressure < 140mmHg and nighttime systolic blood pressure ≥ 120 mmHg