ORIGINAL INVESTIGATION

Successful Blood Pressure Control in the African American Study of Kidney Disease and Hypertension

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Background: The African American Study of Kidney Disease and Hypertension (AASK) is an ongoing trial to evaluate the effect of blood pressure and choice of antihypertensive drug on the rate of decline of renal function.

Objective: To present the success of the AASK in achieving the trial's rigorous blood pressure goals in an extremely challenging patient population.

Methods: The AASK participants included African American patients with hypertension (n=1094), aged 18 to 70 years, with glomerular filtration rates between 20 and 65 mL/min per 1.73 m^2 and no other identified causes of renal insufficiency. Participants were randomized to a goal mean arterial blood pressure (MAP) of either 102 to 107 mm Hg (usual MAP goal) or 92 mm Hg or less (low MAP goal). Participants in each of these groups were also randomized (double-blind) to a regimen containing metoprolol succinate, ramipril, or amlodipine besylate. Additional agents were added, if required, in the following recommended order: furosemide, doxazosin mesylate, clonidine hydrochloride, or hydralazine hydrochloride (or minoxidil, if needed).

Results: In participants randomized to the low MAP goal, the percentage of participants who achieved a blood pressure of less than 140/90 mm Hg increased from a baseline of 20.0% to 78.9% by 14 months after randomization. For usual MAP goal participants, the corresponding percentages increased from 21.5% to 41.8%. The difference in median levels of MAP between the 2 MAP goal groups increased and remained at approximately 12 mm Hg. Blood pressure reduction was similar regardless of age, sex, body mass index, education, insurance or employment status, income, or marital status.

Conclusion: The blood pressure goals set and achieved in AASK participants clearly demonstrate that adequate blood pressure control can be achieved even in hypertensive populations whose blood pressure is the most difficult to control.

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HYPERTENSION IS prevalent in 28% of the US population and 35% of the African American population.[1] However, only 1 in 4 patients with hypertension is controlled to a blood pressure of less than 140/90 mm Hg.[2] There are multiple explanations proposed to explain the low control rates in the United States, including inappropriate or inadequate treatment, nonadherence with medical regimen, intake of exogenous substances that interfere with the antihypertensive regimen, biologic factors associated with resistance, and secondary forms of hypertension.[2,3]

In addition to having a higher prevalence of hypertension, African American patients have an earlier onset of hypertension, higher rates of more severe hypertension, and a greater burden of target organ damage.[4,5] There is also evidence that African American patients who receive an early and adequate regimen of antihypertensive drugs achieve similar overall control in blood pressure and experience a greater reduction in cardiovascular disease incidence than white patients.[6,7] Thus, control of blood pressure may substantially reduce the hypertension-related morbidity and mortality in this population.

The African American Study of Kidney Disease and Hypertension (AASK) is an ongoing, 21-center, randomized, double-masked trial to determine the effect of lower blood pressure levels and choice of initial antihypertensive drug selection on the rate of decline of glomerular filtration rate (GFR) assessed by iothalamate clearance.

Author affiliations are listed at the end of this article.
A complete list of the members of the African American Study of Kidney Disease and Hypertension Study Group appears on page 1642.
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PATIENTS AND METHODS

PATIENTS

The design of this randomized, double-masked, 3 × 2 design trial has been published elsewhere.[11] The AASK group includes self-identified African American participants (n = 1094), aged 18 to 70 years, with hypertension defined by a diastolic blood pressure of 95 mm Hg or more, renal insufficiency defined by iothalamate-determined GFR between 20 and 65 mL/min per 1.73 m^2, and no other identified causes of renal insufficiency. For participants undergoing antihypertensive therapy at study entry, the blood pressure entry criteria were based on a single diastolic blood pressure of 95 mm Hg or more. If necessary, antihypertensive therapy was back-titrated until the blood pressure criteria were met. Patients were excluded for known history of type 1 or 2 diabetes mellitus (or fasting glucose level ≥140 mg/dL [7.77 mmol/L] or random glucose level >200 mg/dL [11.1 mmol/L]), urinary protein–creatinine ratio of more than 2.5, accelerated or malignant hypertension within 6 months, secondary hypertension, evidence of non–blood pressure–related causes of renal disease, serious systemic disease, clinical congestive heart failure, or specific indication for or contraindication to one of the randomized classes of antihypertensive agents or study procedures. The institutional review boards at each center approved the study protocol and procedures, and all participants gave written informed consent before study entry.

ANTIHYPERTENSIVE PROTOCOL

Participants were randomized to a goal blood pressure based on MAP of either 102 to 107 mm Hg (usual MAP goal) or 92 mm Hg or less (low MAP goal). In participants randomized to the usual MAP goal, if systolic blood pressure was 160 mm Hg or more, systolic blood pressure was reduced to below this level, even if MAP decreased to less than 102 mm Hg. Blood pressure goals were known to participants and investigators. In addition, participants were also randomized (double-blind) to an antihypertensive regimen containing sustained-release metoprolol succinate (50-200 mg/d) (Toprol XL; Astra-Zeneca Pharmaceuticals, Wayne, Pa), ramipril (2.5-10 mg/d) (Altace; King Pharmaceuticals, Bristol, Tenn), or amlodipine besylate (2.5-10 mg/d) (Norvasc; Pfizer, Inc, New York, NY). The blinded agents selected required only once-daily dosing. Participants were prescribed 1 capsule and 1 tablet once daily that contained the blinded active medication and respective placebo. If the blood pressure goal was not achieved, additional agents were added in the following recommended order: furosemide, doxazosin, clonidine hydrochloride, or hydralazine hydrochloride (or minoxidil, if needed). All add-on medications were generic formulations and were administered twice daily. Some centers used clonidine patches (Catapres; Boehringer Ingelheim Pharmaceuticals, Ridgefield, Conn), which were administered once a week. The dosage of each agent (including the blinded agents) was titrated to the maximum tolerated dose before the addition of a subsequent agent. In those participants randomized to the usual MAP goal and whose MAP fell below 102 mm Hg, the use of antihypertensive drugs was reduced, starting with the most recently added agent. All antihypertensive drugs were provided at no charge to the participant.

An aggressive protocol to achieve and maintain the blood pressure goals was incorporated into the study. Participants were seen every 2 months, and feedback was provided to them concerning their blood pressure, blood pressure goals, and medication consumption (pill counts). In addition, participants whose blood pressures were more than 5 mm Hg above their MAP goal at 2 consecutive visits were required by protocol to be seen within 2 weeks. Centralized staff training and adherence aids were provided by the trial, and participants whose blood pressures were consistently outside the MAP goal were reviewed by the MAP goal, adherence, and/or clinical management subcommittees to address specific problems encountered with individual patients.

BLOOD PRESSURE MEASUREMENT

Seated blood pressures were measured using a Hawksley random zero sphygmomanometer after at least 5 minutes of rest, and standing readings were recorded after 2 minutes, according to standard protocols.[12,13] Participants were instructed to avoid smoking and caffeinated beverages before each visit. Three consecutive seated readings were obtained with the mean of the last 2 readings recorded. All personnel responsible for measuring and recording blood pressures were centrally trained and certified annually to measure blood pressures according to standard methods. Random zero machines were calibrated quarterly and inspected weekly. Digit preference, differences in duplicate measurements, and means by the center and technician were analyzed and reviewed for quality control.

During a 6-month titration period following randomization, blood pressure was measured and medications were adjusted at monthly protocol visits (and as many interim visits as required) to achieve the blood pressure goal. Subsequently, protocol visits were performed at 2-month intervals. These intervals represented the visit window. If MAP was greater than 5 mm Hg above goal for 2 consecutive visits, the study protocol required the clinical centers to schedule another visit within 2 weeks to assess blood pressure control and re-evaluate the antihypertensive regimen.

The baseline blood pressures were those obtained at the initial screening visit before randomization and before modification of medications for backward titration. The follow-up blood pressures reported represent the mean of all blood pressures measured within a given visit window, including those at interim visits. The blood pressures that were consistently outside the MAP goal were reviewed by the MAP goal, adherence, and/or clinical management subcommittees to address specific problems encountered with individual patients.

The baseline blood pressures were those obtained at the initial screening visit before randomization and before modification of medications for backward titration. The follow-up blood pressures reported represent the mean of all blood pressures measured within a given visit window, including those at interim visits. These blood pressures were assessed for each of 6-month visit windows in the first 6 months after randomization and for 2-month visit windows thereafter. For each participant, mean blood pressures were computed for each visit window by unweighted averages of all blood pressure measurements within that window. The blood pressures reported also included those taken on days when GFRs were measured and those measured at home blood pressure visits by clinic personnel (<3% of readings).

Demographic information was obtained at baseline by specific questions asked of the participant. In addition to

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blood pressure measurements, the dose blood pressure measurements, the dose and type of all medications were assessed at each follow-up visit. Symptoms of hypotension (dizziness and syncope) were specifically elicited, and other new symptoms (volunteered) were recorded at each visit.

STATISTICAL ANALYSIS

As described herein, blood pressure was summarized for each visit window by averaging the systolic and diastolic blood pressures and the MAP within the window. The long-term average blood pressure for a particular patient throughout follow-up was quantified by the mean of the averaged blood pressures within the successive visit windows, starting with the fifth month after randomization. This method of averaging ensures that each follow-up window is given equal weight as long as at least one blood pressure measurement was obtained in the window. Since blood pressures must be significantly different between the low and usual blood pressure goals by design, data analyses of blood pressure are descriptive and include summaries using frequency tables and box plots. Standard comparisons of binomial proportions are used to compare the rates of symptoms between the blood pressure goals and to compare the rates between patients at or below goal vs those above goal at selected follow-up visits.

Table 1. Baseline Demographics of 1094 Randomized African American Study of Kidney Disease and Hypertension Participants*

Factor	Usual MAP Goal (n = 554)	Low MAP Goal (n = 540)	Whole Cohort
Age, mean ± SD, y	54.5 ± 10.4	54.4 ± 10.9	54.5 ± 10.7
Sex, M/F	60/40	62/38	61/39
Body mass index, mean ± SD†	30.6 ± 6.5	30.5 ± 6.7	30.6 ± 6.6
Creatinine, mg/dL‡	2.05 ± 0.72	2.00 ± 0.72	2.02 ± 0.72
Cockcroft-Gault creatinine clearance, mL/min per 1.73 m^2	45.4 ± 14.3	46.5 ± 14.3	52.1 ± 22.0
GFR, mL/min per 1.73 m^2	45.3 ± 13.2	46.1 ± 12.8	45.7 ± 13.0
Systolic blood pressure, mm Hg	149 ± 23	152 ± 25	151 ± 24
Diastolic blood pressure, mm Hg	95 ± 14	96 ± 15	96 ± 14
MAP, mm Hg	113 ± 15	115 ± 17	114 ± 16
Education, %			
<High school diploma	41	40	41
High school diploma	28	32	30
>High school diploma	31	28	29
Family income, %			
<$15 000	47	48	48
$15 000-$40 000	25	26	26
Declined to provide information	19	18	19
Employed, %	39	35	37
Duration of hypertension, mean ± SD, y	14 ± 10	14 ± 11	14 ± 10

*MAP indicates mean arterial blood pressure; GFR, glomerular filtration rate.
†Calculated as weight in kilograms divided by the square of height in meters.
‡To convert creatinine to micromoles per liter, multiply by 88.4.

Table 2. Blood Pressures at Entry Into the African American Study of Kidney Disease and Hypertension and During Follow-up*

Follow-up Visit, mo	No. of Participants	Mean SBP/DBP, mm Hg	Median SBP/DBP, mm Hg	Mean MAP, mm Hg	Median MAP, mm Hg	At Goal, %	Above Goal, %	Below Goal, %	SBP/DBP ≤140/90, %
Low Blood Pressure Goal									
Baseline	534	151.8/96.3	150.0/97.0	115.0	114	8.4	91.6	0	20.0
5	495	130.1/79.6	128.0/78.0	96.6	94	45.9	54.1	0	71.9
14	470	127.9/78.2	125.6/77.0	94.9	92	52.3	47.7	0	78.9
20	377	127.4/77.3	125.0/76.0	94.2	92	51.5	48.5	0	77.2
26	314	126.1/76.5	124.0/76.0	93.3	91	59.6	40.4	0	80.6
32	254	125.5/76.7	123.0/76.0	93.1	91	59.1	40.9	0	81.1
Usual Blood Pressure Goal									
Baseline	545	149.4/95.0	147.0/96.0	113.3	113	10.1	68.4	21.5	21.5
5	484	140.1/86.4	139.0/86.0	104.5	104	40.5	28.1	31.4	42.6
14	447	140.1/85.8	139.0/86.0	104.1	104	42.3	26.8	30.9	41.8
20	360	140.6/85.4	139.3/85.0	104.0	104	43.3	24.7	31.9	38.1
26	303	139.7/84.8	139.6/85.0	103.3	104	39.3	25.7	35.0	41.3
32	247	139.6/84.4	140.0/85.0	103.1	104	45.7	21.5	32.8	42.1

*Data include blood pressure measurements after stop points. Data current as of November 1, 1999. SBP indicates systolic blood pressure; DBP, diastolic blood pressure; and MAP, mean arterial blood pressure.

The AASK participants are randomized to an antihypertensive regimen initiated with either an angiotensin-converting enzyme (ACE) inhibitor (ramipril), a dihydropyridine calcium channel blocker (amlodipine besylate), or a sustained-release β-blocker (metoprolol succinate). In addition, they are randomized to 1 of 2 blood pressure goals based on mean arterial blood pressure (MAP), either 102 to 107 mm Hg (inclusive), approximating the usual level of blood pressure control of 140/90 mm Hg, or to 92 mm Hg or less, approximating the lower goal of less than 125/75 mm Hg. The trial is scheduled to complete patient follow-up in 2001, with an average follow-up of 3 to 6 years.

A major challenge in the conduct of AASK is the need to achieve and maintain the aggressive blood pressure goals demanded by the protocol. Several previous large trials have failed to show a difference in outcome, in part because of poor separation between the blood pressures achieved in the randomized groups.[8-10] In addition, these tight blood pressure goals need to be achieved in a popu-

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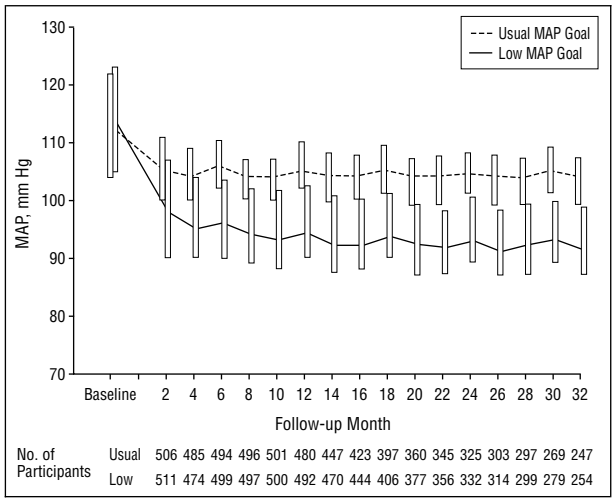

Figure 1. Separation of mean arterial blood pressure (MAP) over time. Values represent monthly mean MAP with 95% confidence intervals (error bars).

lation of hypertensive patients historically perceived to have more severe blood pressure elevation and to be more resistant to therapy (especially to monotherapy with 2 of the classes used in this trial, β-blocker and ACE inhibitor). Furthermore, because of the study population's lower education level, fewer financial resources, and less positive interaction with the health care system, long-term maintenance of blood pressure control was also expected to be a challenge. Thus, this study provides a severe test of the feasibility of achieving lower-than-usual blood pressures in a population at high risk to progress to hypertensive end-stage renal disease.

RESULTS

The baseline demographics of the randomized AASK participants are given in **Table 1**. The AASK participants have a mean age of 54.5 years, an average reported duration of hypertension of 14 years, and an average GFR of 45.7 mL/min per 1.73 m^2. Although patients were prescribed a mean of 2.4 medications, baseline rates of blood pressure control to less than 140/90 mm Hg was only 20%. Blood pressure control to the recommended level for patients with renal insufficiency of less than 130/85 mm Hg was only 11.2%.[2,14,15] Surprisingly, almost 40% of these African American patients with renal insufficiency were not prescribed diuretics at the time that they were screened for AASK. The following is a list of antihypertensive drugs prescribed at study entry for the 1094 study participants (there was an average of 2.4 medications prescribed).

Antihypertensive Class	% Prescribed
Calcium channel blockers	64
Diuretics	62
ACE inhibitors	38
β-Blockers	28
Central α-agonists	20
α-Blockers	13
Vasodilators	16
None of the above	3

After randomization, blood pressure control within the AASK cohort significantly improved. For participants randomized to the low blood pressure goal, the percentage of participants who achieved an MAP of less than 107 mm Hg increased from 30.0% to 87.7% (data not shown) and the percentage who achieved a blood pressure of less than 140/90 mm Hg increased from 20.0% to 78.9% at 14 months of participation in the trial (**Table 2**). For participants randomized to the usual goal, the corresponding percentages increased from 31.7% to 73.1% and from 21.5% to 41.8%. **Figure 1** shows the level of separation in MAP between the usual and low blood pressure (MAP) goals at follow-up visits in the study. Since blood pressures at 6-month intervals corresponded to GFR visits, we present the blood pressures following the GFR visits. Blood pressures taken at GFR visits averaged 3.5 mm Hg higher than those taken at non-GFR visits for participants randomized to the usual MAP goal and 2.7 mm Hg higher than those taken at non-GFR visits for participants randomized to the low MAP goal. The separation in blood pressure between those randomized to usual and low MAP goals increased gradually during

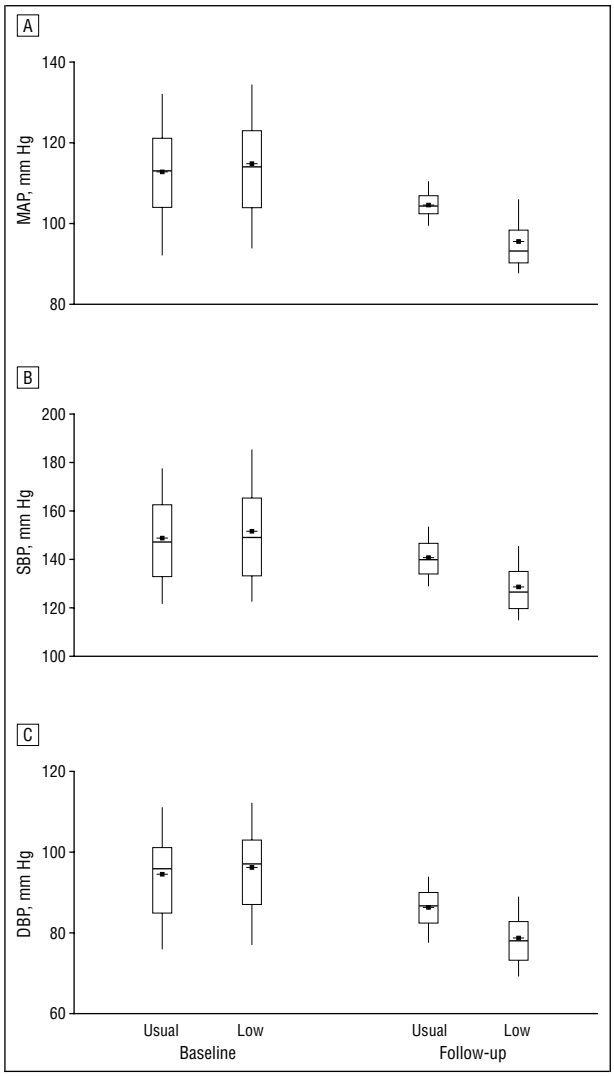

Figure 2. Comparison of mean arterial blood pressure (MAP) (A), mean systolic blood pressure (SBP) (B), and mean diastolic blood pressure (DBP) (C) (±95% confidence intervals [error bars]) in participants randomized to the usual (Usual) and low (Low) blood pressure goals at baseline and last follow-up visits.

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Table 3. Blood Pressure Control in Selected Subgroups*

Subgroup	Baseline MAP	Usual Blood Pressure Goal: Mean Follow-up MAP	Usual Blood Pressure Goal: Change From Baseline to Follow-up MAP	Low Blood Pressure Goal: Mean Follow-up MAP	Low Blood Pressure Goal: Change From Baseline to Follow-up MAP
Age, y					
<50	117.5 (18.5)	106.5 (6.32)	−10.2 (15.6)	98.2 (9.57)	−20.0 (19.2)
≥50	112.1 (14.6)	103.7 (5.29)	−7.5 (14.2)	94.2 (6.79)	−19.0 (15.1)
Sex					
M	114.4 (16.7)	104.7 (5.90)	−8.4 (14.6)	95.5 (7.70)	−20.1 (17.3)
F	113.0 (15.2)	104.3 (5.57)	−8.2 (14.8)	95.6 (8.54)	−17.9 (15.2)
GFR, mL/min per 1.73 m^2					
<40	114.6 (16.7)	104.6 (6.11)	−9.4 (14.5)	96.4 (8.17)	−18.9 (17.4)
≥40	113.4 (15.9)	104.5 (5.58)	−7.7 (14.7)	95.1 (7.92)	−19.5 (16.1)
BMI					
<28	112.7 (15.5)	104.1 (6.41)	−8.8 (13.8)	95.0 (7.94)	−17.5 (15.8)
≥28	114.6 (16.5)	104.8 (5.34)	−8.0 (15.2)	95.8 (8.09)	−20.7 (16.7)
Education					
<High school diploma	113.2 (15.3)	103.8 (5.44)	−8.0 (14.3)	94.2 (7.01)	−20.4 (15.6)
High school diploma	115.0 (17.0)	104.6 (5.65)	−9.8 (16.1)	97.1 (9.52)	−18.5 (16.9)
>High school diploma	113.5 (16.3)	105.6 (6.17)	−7.2 (13.8)	95.6 (7.21)	−18.6 (17.4)
Employment status					
Employed	114.4 (15.9)	105.6 (5.97)	−7.5 (14.3)	95.5 (8.52)	−20.3 (15.3)
Unemployed	115.4 (17.4)	105.1 (4.89)	−9.4 (15.1)	96.9 (8.42)	−19.4 (19.8)
Other	111.8 (15.1)	102.8 (5.88)	−8.1 (14.8)	94.4 (7.03)	−18.3 (14.0)

*MAP indicates mean arterial blood pressure; GFR, glomerular filtration rate; and BMI, body mass index. (Calculated as weight in kilograms divided by the square of height in meters).

Table 4. Number of Medications Required to Achieve Blood Pressure Control*

Follow-up Visit, mo	Blood Pressure Goal	Usual Blood Pressure: No. of Participants	Usual Blood Pressure: No. of Drugs	Low Blood Pressure: No. of Participants	Low Blood Pressure: No. of Drugs
4	Above goal	145	3.17	279	3.43
	At goal	190	2.55	177	3.01
	Below goal	142	2.47	0	. . .
8	Above goal	120	3.31	267	3.63
	At goal	212	2.72	206	3.29
	Below goal	148	2.44	0	. . .
14	Above goal	114	3.18	215	3.73
	At goal	183	2.73	229	3.50
	Below goal	127	2.47	0	. . .
20	Above goal	88	3.31	168	3.89
	At goal	146	2.68	182	3.47
	Below goal	103	2.65	0	. . .
26	Above goal	75	3.39	115	3.96
	At goal	112	2.81	171	3.41
	Below goal	94	2.59	0	. . .
32	Above goal	50	3.46	91	3.92
	At goal	106	3.00	136	3.42
	Below goal	70	2.40	0	. . .

*All the patients with antihypertensive drugs listed on form 5 are included in the analysis. Data current as of November 1, 1999.

approximately the first 14 months after randomization, after which the difference in median levels of MAP remained at about 12 mm Hg. **Figure 2** provides greater detail on the change in distribution of blood pressure levels between study entry and the median of each patient's follow-up blood pressures in the usual and low blood pressure groups. Both the mean levels and the variability of the follow-up systolic blood pressure, diastolic blood pressure, and MAP were substantially lower than the mean and variability of these measures at study entry.

Blood pressure reduction, whether defined by the level of achieved MAP or by the magnitude of the blood pressure reduction, was similar regardless of age, sex, body mass index, education, insurance or employment status, income, or marital status (**Table 3**). Although the blood pressure levels and percentage of participants achieving MAP goals are presented for the whole co-

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Table 5. Percentage of African American Study of Kidney Disease and Hypertension Participants Reporting Symptoms

		Usual Blood Pressure Goal							Low Blood Pressure Goal						
Follow-up Visit, mo	Blood Pressure Goal	No. of Participants	Shortness of Breath	Syncope	Dizziness	Rapid Heart Rate	Light-headed	Muscular Weakness	No. of Participants	Shortness of Breath	Syncope	Dizziness	Rapid Heart Rate	Light-headed	Muscular Weakness
4	Above goal	146	14.4	0	15.8	9.6	11.6	6.8	290	10.7	0	10.7	10.0	12.4	7.9
	At goal	195	3.6	0	4.1	3.1	8.2	2.6	184	10.3	0	8.7	8.2	9.2	4.4
	Below goal	144	10.4	1.4	9.7	5.6	9.0	8.3	0	. . .	. . .	. . .	. . .	. . .	. . .
8	Above goal	122	11.5	0	18.0	9.8	18.9	10.7	279	13.6	0.7	14.7	10.0	17.2	7.2
	At goal	219	9.6	0	7.3	6.8	7.8	5.0	218	9.2	0.5	11.9	8.3	10.6	5.0
	Below goal	155	12.3	0.6	14.2	12.3	14.8	10.3	0	. . .	. . .	. . .	. . .	. . .	. . .
14	Above goal	120	16.7	1.7	12.5	10.0	10.0	9.2	224	16.1	0.9	11.2	10.7	13.4	7.6
	At goal	189	9.5	0	4.8	5.3	5.8	5.3	246	6.1	0.8	8.5	7.3	9.8	5.3
	Below goal	138	14.5	2.2	13.0	8.0	13.8	10.1	0	. . .	. . .	. . .	. . .	. . .	. . .
20	Above goal	89	14.6	0	7.9	4.5	11.2	10.1	183	11.5	0.6	12.0	10.9	11.5	7.6
	At goal	156	11.5	0	7.7	6.4	7.7	6.4	194	6.2	1.0	8.2	5.2	8.8	5.2
	Below goal	115	14.8	0	9.6	5.2	10.4	4.4	0	. . .	. . .	. . .	. . .	. . .	. . .
26	Above goal	78	5.1	0	10.3	9.0	10.3	2.6	127	13.4	0	11.8	9.4	15.0	7.1
	At goal	119	8.4	0.8	8.4	6.7	9.2	4.2	187	11.8	0.5	11.8	8.6	9.6	8.6
	Below goal	106	14.2	0.9	12.3	10.4	15.1	7.6	0	. . .	. . .	. . .	. . .	. . .	. . .
32	Above goal	53	11.3	0	11.3	13.2	9.4	5.7	104	17.3	1.0	12.5	9.6	13.5	7.7
	At goal	113	15.9	0	10.6	4.4	12.4	6.2	150	7.3	0	7.3	8.0	10.7	5.3
	Below goal	81	8.6	0	4.9	4.9	7.4	7.4	0	. . .	. . .	. . .	. . .	. . .	. . .

hort, the results were similar whether the entire cohort or a fixed cohort of participants with readings available for 3 years is examined. Including the small number of participants (2.8%) who required having their blood pressures measured at home visits had no discernible effect on the overall blood pressure results.

Participants at or below MAP goal received an average of 2.7 and 3.5 agents in the usual MAP goal and low MAP goal groups, respectively (**Table 4**). The AASK participants above MAP goal are prescribed, on average, a greater number of agents than those participants at or below goal, suggesting that resistance to treatment or nonadherence rather than underprescribing of antihypertensive drugs was the reason for the inability to achieve MAP goal.

Table 5 lists the reported hypotensive-related complaints in participants according to randomized group and to whether participants are above, at, or below blood pressure goal. No increase in the incidence of hypotensive symptoms was reported in participants whose blood pressure was reduced to or below the MAP goal.

COMMENT

For the AASK to meet its objective of evaluating whether lower-than-usual blood pressure will reduce the rate of decline of GFRs in patients with hypertensive renal disease, 2 goals had to be achieved. First, consistent blood pressure separation between the participants randomized to the 2 goals had to be achieved. Second, better blood pressure control than has been achieved in previous long-term trials had to be achieved and maintained. These goals have been met in the very challenging population of African American patients with hypertension and renal disease. In the Modification of Diet in Renal Disease Study,[8] in which less than 10% of participants were African American and only 18 African American participants had hypertensive renal disease, planned MAP separation was 10 mm Hg, but only a 5-mm Hg separation was achieved. The Hypertensive Optimal Treatment trial had a goal of 5-mm Hg diastolic blood pressure separation among its 3 treatment groups. However, only a 2-mm Hg separation among the 3 groups was achieved.[9] In the Appropriate Blood Pressure Control in Diabetics trial, the upper diastolic blood pressure goal (80-90 mm Hg) was achieved (achieved=86 mm Hg); however, the lower diastolic blood pressure goal (75 mm Hg) was not (achieved=78 mm Hg).[10]

Thus far, the AASK has more than met its goal of more than a 10-mm Hg separation in MAP. Unlike previous trials in which one of the inclusion criteria was a high likelihood of achieving the blood pressure goal (often with monotherapy), the only blood pressure exclusion criteria in AASK was a recent history (<6 months) of accelerated or malignant hypertension. The high rates of overall blood pressure control suggest that initial drug choice did not have an overriding impact, although it is still not clear whether the choice of antihypertensive regimen influenced the level of blood pressure control or number of agents required to achieve control. The differential effectiveness of the treatment regimens will have to await unblinding.

One factor that clearly contributed to control was the concentrated effort to reach the blood pressure goal and the aggressive use of add-on agents to achieve these goals. The average number of agents required to reach the blood pressure goals was approximately 3 agents. This is similar to findings in other trials, regardless of hypertensive severity.[9,16,17] Of interest also was the tolerability of AASK participants to aggressive blood pressure lowering. There was no evidence of increased drug-related or blood pressure–related symptoms whether comparing incidence of adverse symptoms between usual and low goal groups or examining reports of participants within randomized groups whose blood pressure was

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The African American Study of Kidney Disease in Hypertension Study Group

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above goal, at goal, or below goal (usual goal group). This is consistent with the findings from the Treatment of Mild Hypertension Study (TOMHS),[18] Hypertensive Optimal Treatment,[19] and Syst-Eur trials.[20] A more detailed report of the effect of the randomized regimens on quality of life will be forthcoming from the AASK trial.

Finally, the AASK trial provides further evidence of the feasibility of achieving the blood pressure control rates advocated for the United States by the year 2010.[21] The blood pressure goals set and achieved in AASK participants clearly demonstrate that adequate blood pressure control can be achieved even in the most difficult-to-control hypertensive populations. It is noteworthy that these blood pressure rates were achieved despite the limited formulary available for prescribers because of the randomized treatment groups. Thus, there is a potential for even better blood pressure control if ACE inhibitors, calcium channel blockers, and β-blockers had been available to all patients. Thus, the blood pressure goals set for participants in the AASK trial are being achieved. The study should effectively evaluate the efficacy of the 2 blood pressure goals and choice of antihypertensive drug regimens in preventing progression of hypertensive renal disease.

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