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Blood pressure and the new ACC/AHA hypertension guidelines ☆

John M. Flack [a,*], Bemi Adekola [b]

[a] Department of Medicine, Division of General Internal Medicine, Hypertension Section, Southern Illinois University, Springfield, IL, United States
[b] Department of Medicine, Division of Nephrology, Hypertension Section, Southern Illinois University, Springfield, IL, United States

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ABSTRACT

The ACC/AHA hypertension guidelines cover virtually all aspects of the diagnosis, evaluation, monitoring, secondary causes as well as drug and non-drug treatment of hypertension. Substantial and appropriate emphasis has been given to the strategies necessary for accurate measurement of blood pressure in any setting where valid blood pressure measurements are desired. Most "errors" made during blood pressure measurement bias readings upwards resulting in over-diagnosis of hypertension and, amongst those already on drug therapy, underestimating the true magnitude of blood pressure lowering resulting in over-treatment. Hypertension is diagnosed when blood pressure is consistently ≥130 and/or ≥80 mm Hg. However, the majority of patients with hypertension between 130–139/80–89 mm Hg (stage 1 hypertension) do not qualify for immediate drug therapy. The guideline breaks new ground with some of its recommendations. Absolute cardiovascular risk is utilized, for the first time, to determine high-risk status when BP 130–139/80–89 mm Hg (Stage 1 hypertension) and high-risk patient characteristics/comorbidities are absent including age 65 and older, diabetes, chronic kidney disease, known cardiovascular disease; high-risk individuals initiate drug therapy when BP ≥ 130/80 mm Hg. The exception amongst high-risk individuals is for secondary stroke prevention in drug naïve individuals as drug therapy is initiated when blood pressure ≥140/90 mm Hg. Non-high risk individuals will initiate drug therapy when BP is ≥140/90 mm Hg. Irrespective of blood pressure threshold for initiation of drug therapy, the target BP is minimally <130/80 mm Hg in most. However, target BP is <130 systolic amongst those 65 and older as the committee made no recommendation for a DBP target. Treatment should be initiated with two drugs having complementary mechanisms of action when blood pressure is >20/10 mm Hg above goal.

Introduction

The focus of hypertension treatment and the controversies surrounding treatment paradigms have evolved significantly over time. Historically, the focus has been on determining the single drug therapy that provided superior cardiovascular disease (CVD) risk reduction. However, the contemporary focus of hypertension treatment has appropriately shifted to the following: 1) the patient characteristics (age, absolute 10-year ASCVD risk, known CVD, and comorbidities) that determine the BP level at which antihypertensive drug therapy will be initiated, and 2) the level to which BP should be minimally lowered to for optimal protection against pressure-related CVD events. The latter will be infrequently accomplished using single drug therapy.

The ACC/AHA hypertension treatment guidelines are evidence-based and comprehensive, covering virtually all aspects of hypertension including diagnosis, patient evaluation and monitoring, secondary causes as well as drug and non-drug treatments. The guideline places substantial (and appropriate) emphasis on strategies necessary for the accurate measurement of BP [1]. Though the level of evidence (including expert opinion) and the strength of the recommendation were provided for major recommendations, they will receive only passing mention in the subsequent text. The primary aim of this document is to provide a condensed overview of the most important recommendations in the ACC/AHA guideline regarding the diagnosis, evaluation and treatment of hypertension in the ambulatory setting. Accordingly, subsequent commentary reflects guidance contained in the ACC/AHA guidelines unless otherwise stated. Also, comparisons will be made between recommendations made in the ACC/AHA guideline with those made by other hypertension guideline committees.

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* Corresponding author.
E-mail addresses: Jflack47@siumed.edu, jmarkguppy@aol.com (J.M. Flack).

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Highlights of ACC/AHA hypertension guidelines

BP categories

New BP categories are: 1) normal (<120 systolic and <80 mm Hg diastolic), 2) elevated (120–129 systolic and <80 mm Hg diastolic), 3) stage 1 hypertension (130–139 systolic or 80–89 mm Hg diastolic) and stage 2 hypertension (≥140 systolic or ≥90 mm Hg diastolic). These categories should not be based on BP readings at a single point in time but rather should be confirmed by two or more readings (averaged) made on at least two separate occasions. Individuals are classified according to their highest systolic or diastolic BP category. Out of office BP readings (home or ambulatory BP monitoring) should also be obtained for comparison with office BP readings. The BP category of pre-hypertension is no longer used.

BP measurement

The guideline provides extensive guidance regarding how to measure BP accurately. Accurate BP measurement in office and home settings is required to minimize errors when diagnosing hypertension, monitoring BP longitudinally and making therapeutic decisions about changing the intensity of drug therapy. The ACC/AHA guideline provides an extensive algorithm for accurate BP measurement that is unlikely to be followed in ambulatory clinic and home settings. Nevertheless, the following are 7 strategies recommended by the AHA/AMA (https://www.heart.org/en/news/2018/05/01/aha-ama-launch-high-blood-pressure-initation) for accurate attainment of BP: 1) no conversation, 2) empty bladder, 3) use correct cuff size, 4) place BP cuff on bare arm, 5) support arm at heart level, 6) keep legs uncrossed, and 7) support back and feet. Validated home and office BP measurement devices can be found at the British and Irish Hypertension Society website (https://bihsoc.org/bp-monitors/).

Most of the "errors" made during measurement of BP – cuff too small, cuff applied to arm over clothing, measurement arm hanging, full bladder, legs crossed and/or hanging - bias readings upwards. Accordingly, the usual approach to measurement of BP in clinical settings will lead to over-diagnosis and over-treatment of patients with hypertension. Irrespective of measurement location – the office or at home – the strategies for accurate measurement of BP are similar, if not identical. That is, measuring BP with validated BP measurement devices used in conjunction with a standard measurement protocol.

White coat and masked hypertension

White coat hypertension is defined as office BP is ≥130/80 mm Hg but out of office (home or daytime ambulatory BP) <130/80 mm Hg after 3 months of diet and lifestyle modification. In drug naïve hypertensives, this hypertension phenotype should be considered in individuals with office BP 130–159/80–99 mm Hg. Masked hypertension also represents non-concordance between office and out of office BP readings and is defined as office BP < 130/80 mm Hg but home or daytime ambulatory BP ≥ 130/80 mm Hg. This hypertension phenotype should be considered in individuals with office BP 120–129/< 80 mm Hg after a three month trial of diet and lifestyle intervention. In my experience, the primary reason for this diagnosis has been poor BP measurement technique at home rather than actual masked hypertension.

Patient evaluation

Recommended tests include fasting blood glucose, CBC, lipids profile, serum creatinine with estimated glomerular filtration rate (eGFR), electrocardiogram, urinalysis and TSH; optional tests include an echocardiogram, uric acid, and urine albumin: creatinine ratio. Early on diabetes is a post-prandial rather than a fasting disease thus strong consideration should be given to adding hemoglobin A1C to the list of recommended tests. This allows, without fasting, detection of pre-diabetes as well as early diabetes as the fasting glucose level may be normal in both. Prescribed and over the counter drugs consumed by patients should be carefully scrutinized for agents known to raise BP (e.g., NSAIDs, steroids, oral contraceptives).

Blood pressure treatment initiation thresholds and on-treatment targets

The ACC/AHA guidelines dissociated the BP threshold for the diagnosis of hypertension from the BP threshold for initiation of pharmacological therapy and, in most patients the latter is distinct from the on-target blood pressure. High-risk patients, those with diabetes, CKD (eGFR <60 ml/min/1.73 m^2 and/or urine albumin: creatinine ratio ≥300 mg/g), post-renal transplantation, heart failure with reduced or preserved ejection fraction, known CVD, peripheral arterial disease, and/or ≥10% ten year ASCVD risk qualify for antihypertensive drug therapy when BP is persistently ≥130 systolic and/or ≥80 mm Hg; the on-treatment target BP is <130/80 mm Hg. The 10-year ASCVD risk calculator can be accessed at www.cvriskcalculator.com. Secondary (non-lacunar) stroke prevention in antihypertensive drug naïve patients is the only high-risk co-morbidity for which the 140/90 mm Hg treatment initiation threshold is recommended. The on-treatment BP target is, however, <130/80 mm Hg.

Lower-risk patients (under 65 years of age), defined as those without the aforementioned high-risk co-morbidities and 10-year ASCVD risk <10%, are recommended for antihypertensive drug therapy when BP is ≥140/90 mm Hg. Similar to most high-risk hypertensives, their target BP is <130/80 mm Hg.

Older adults

Non-institutionalized, even frail, community-dwelling adults aged 65 and older qualify for drug therapy when SBP ≥ 130 mm Hg, however, no DBP treatment threshold or target was given for this group. Target BP is <130 mm Hg systolic. Considerable restraint regarding the intensity of antihypertensive drug therapy should be exercised in older persons with life-limiting medical conditions.

The ACC/AHA guideline recommends making orthostatic BP measurements at the index visit. It is also very prudent to assess older patients for orthostatic hypotension given the higher prevalence of this condition with age. Also, most patients with orthostatic hypotension (≥20/10 mm Hg fall in BP after 2–3 min of standing) do not have symptoms and 2) most with symptoms suggestive of a fall in BP with upright posture do not have orthostatic hypotension. In our clinic we assess all patients 60 years and older at every visit for orthostatic BP change (seated to standing) and use the standing, not seated, BP as their target as long as orthostatic hypotension persists.

Race

The only race specific recommendation in the ACC/AHA guideline was for African Americans. Accordingly, those without heart failure or CKD who do not meet criteria for two-drug therapy should be initially treated with either a thiazide-type diuretic or calcium antagonist. Implicit in the monotherapy recommendations is that RAS blocker drugs should be initially prescribed to African Americans with hypertension with these co-morbidities (CKD and HF) despite the lesser average BP response to monotherapy with

this drug class relative to thiazide diuretics and calcium antagonists. Another recommendation was to encourage the use of two drug combination therapy in most African Americans.

Secondary hypertension

Clinical clues that should raise suspicion for a secondary cause of hypertension include snoring/daytime sleepiness, abrupt onset of hypertension, hypertension onset <30 years of age, accelerated/malignant hypertension, abrupt loss of BP control in a patient with prior BP control, use of BP raising substances such as NSAIDs/amphetamines/immunosuppressive agents, resistant (taking 3 or 4 antihypertensive drugs, including a diuretic and BP above goal or taking ≥4 drugs, including a diuretic and BP below goal) or refractory hypertension (taking ≥5 drugs, including a diuretic, and BP above goal), unprovoked (not taking a diuretic) or excessive hypokalemia, and/or the onset of diastolic hypertension in older patients (≥65 years). Several common causes of secondary hypertension are discussed briefly below.

Sleep apnea will commonly be encountered in patients with resistant and refractory hypertension. Non-restorative sleep, snoring and daytime sleepiness are clinical clues to pursue this diagnosis. Prescription of CPAP, if actually utilized by the patient, does modestly lower BP and CVD risk. Weight loss can also lessen the severity of sleep apnea.

Primary aldosteronism prevalence is approximately 20% in patients with resistant hypertension. Adrenalectomy is the treatment of choice in those ultimately proven to have uni-lateral aldosterone hyper secretion. However, the majority (~60%) of patients with primary aldosteronism have bilateral hyper-secretion and will not be candidates for adrenalectomy.

Trials of renal artery revascularization in patients with critical atherosclerotic renal artery stenosis have provided no to marginal clinical benefit relative to medical therapy [2–4]. Thus, the ACC/AHA guideline recommends medical therapy for atherosclerotic renal artery obstruction in most patients; however, the guideline suggests it is reasonable to consider renal artery revascularization in the following situations (expert opinion): 1) refractory hypertension (uncontrolled BP while taking ≥5 drugs, one of which is a diuretic), 2) worsening renal function (ischemic nephropathy), and/or 3) intractable heart failure. Patients (90% women) with fibromuscular dysplasia are typically diagnosed early in their early 50s. The effective recommended treatment is angioplasty without stenting.

Lifestyle and diet therapy

Diet and lifestyle modifications alone should be prescribed for individuals with white coat hypertension, elevated BP and stage 1 hypertension not qualifying for initial antihypertensive drug therapy. The following diet and lifestyle modifications were recommended: 1) sodium restriction to <1500 mg/d or minimally an absolute reduction of at least 1000 mg/d, 2) increased intake of dietary potassium (3500–5000 mg/d), 3) weight loss if overweight/obese (target ideal body weight or, alternatively, weight loss of at least 1 kg), 4) appropriate physical activity prescription (aerobic or dynamic resistance 90–150 min/week or isometric resistance 3 sessions/week), 5) moderation of alcohol intake (≤2 drinks per day in men, ≤1 per day in women) and 6) a healthy DASH-like diet rich in fruits, vegetables, whole grains and low-fat dairy products with reduced saturated and total fat.

Initiating antihypertensive drug therapy

Importantly, though the diagnosis of hypertension has been confirmed at the 130/80 mm Hg threshold, most patients with stage 1 hypertension (~69%) do not qualify for immediate drug therapy. However, once an individual with hypertension qualifies for pharmacological treatment, including patients with masked hypertension, prescription of drug therapy is recommended to come from one of four drug classes (usual first line therapy) – thiazide diuretics, calcium antagonists, angiotensin converting enzyme (ACE) inhibitors, or angiotensin receptor blockers (ARBs) – unless there is a comorbidity consideration favoring the use of a different drug class (Table 1). The number of antihypertensive drugs to prescribe in drug naïve patients is guided by how far their BP is above target. In patients with BP > 20/10 mm Hg above target, two-drug therapy, either as a single pill combination or two separate pills, should be initiated. Specific guidance was given to avoid the combination of any two of the following drug classes, an ACE inhibitor, an ARB or direct renin inhibitor (dual RAS blockade). Though triple drug single pill combinations are FDA approved and marketed, there is no current indication to initiate therapy with more than two drugs irrespective of the BP level in drug naïve patients. The interest in initiating antihypertensive drug therapy in drug naïve patients with low-dose triple or quadruple combination therapy emanates from the observation that such combination therapy results in additive blood pressure lowering efficacy without additive adverse effects [5]. A meta-analysis comparing triple versus dual combination of angiotensin II receptor blocker (valsartan and olmersatan), HCTZ, amlodipine at any dose resulted in more patients attaining target blood pressure with no increase in the adverse event risk [6]. Similar, substantial blood pressure lowering (reduction in office SBP up to 26 mm Hg) has been reported in quarter-dose quadruple combination therapy [7,8] though treatment-related adverse effects were not elucidated in detail [7]. More recently, a randomized trial comparing a fixed low-dose triple drug combination (telmisartan 20 mg, amlodipine 2.5 mg and chlorthalidone 12.5 mg) to usual care showed quick and sustained target blood pressure attainment in the triple combination therapy group without incremental side effects [9]. Nevertheless, initiating antihypertensive drug therapy with more than 2 agents has not yet been recommended by any contemporary hypertension guideline writing groups.

Treating hypertension in patients with co-morbid conditions

Drug selection and therapeutic approaches to antihypertensive drug therapy are influenced by the presence of selected co-morbid conditions because drugs can favorably or unfavorably impact clinical outcomes in such patients. Table 1 summarizes the selected co-morbidities for which specific guidance in the ACC/AHA guidelines in regards to drug selection and therapeutic approach. Favored drug classes should be prescribed first, in the absence of a major contraindication to their use.

Patient monitoring

Individuals with normal BP readings as well as individuals with white coat hypertension should be rechecked annually; home BP or daytime ambulatory BP monitoring should be measured along with office BP. White coat hypertension transitions to sustained hypertension in 1–5% of patients with this condition each year. Those with elevated BP should have repeat BP measurements every 3–6 months. Individuals with stage 1 hypertension who do not qualify initially drug therapy should also have follow-up every three to six months. Patients initiating drug therapy should be followed approximately monthly for drug titration until their BP is controlled.

Table 1
Treating hypertension with selected comorbidities drug class.

Comorbidity	Favor	Avoid	Comment
Atrial fibrillation (AF)	ARB		ARBs may reduce AF recurrence
Aortic disease	Beta blockers		Patients with thoracic aorta disease
Chronic kidney disease (CKD)	ACEI or ARB		ARB if ACEI not tolerated
Diabetes	ACEI or ARB if albuminuria present		Consider usual first line drugs if no albuminuria
Heart failure (preserved EF)	Diuretics for volume overload		Add ACEI or ARB and beta blocker for incremental BP control; also consider angiotensin receptor – neprilysin inhibitor and mineralocorticoid receptor antagonists
Heart failure (reduced EF)	GDMT beta blockers	Non-DHP calcium antagonists	
Peripheral arterial disease			Consider usual first line drugs
Post-kidney transplant	Calcium antagonist	Use ACEI with caution	Calcium antagonist can improve kidney graft survival and GFR; 1st month post-transplant BP target (<160/90) to avoid hypotension – induced graft thrombosis
Secondary stroke prevention	Thiazide, ACEI, ARB or thiazide + ACEI combination		If previously treated, restart drugs a few days post-event; if not previously treated, start drug treatment a few days post-event if BP ≥140/90.
Stable ischemic heart disease	GDMT beta blockers ACEI or ARB		
• Angina	GDMT beta blockers		Add DHP calcium antagonists for additional BP control
• Post-MI or ACS	GDMT beta blockers		
Valvular heart disease			
• Aortic stenosis (asymptomatic)			Initiate treatment with low medication doses and up-titrate slowly
• Aortic insufficiency	Avoid beta blockers, non-DHP calcium antagonists		Avoid drugs that slow heart rate

Abbreviations: AF, atrial fibrillation; ACS, acute coronary syndrome; ACEI, angiotensin converting enzyme inhibitors; BP, blood pressure; DHP, dihydropyridine; EF, ejection fraction; GDMT, beta blockers guideline directed medical therapy (carvedilol, metoprolol succinate, bisoprolol); MI, myocardial infarction.

Dueling Guidelines, consensus and scientific statements

These documents are typically long, extensively referenced, and the body of data considered are rigorously assessed. Nevertheless, rarely are these documents read in their entirety by clinical practitioners. Also, their expansive recommendations can substantively differ creating confusion for practitioners as well as never-ending debates amongst hypertension experts regarding the relative merits of the conflicting advice.

There are substantive differences in the ACC/AHA [1] and American College of Physicians (ACP)/American Academy of Family Practice (AAFP) [10] guidelines on hypertension treatment of hypertension in older persons. In the ACP/AAFP guidelines, those ≥60 years of age have a drug therapy initiation BP threshold (and on-treatment target) <150 mm Hg systolic. The ACP/AAFP guideline [10] also recommended initiation or intensification of drug therapy when SBP ≥ 140 mm Hg for secondary stroke prevention as well as in patients post-TIA to achieve a target BP below this level. A direct conversation with the ACP guideline committee clarified their rationale for recommending the 150 mm Hg systolic BP drug therapy initiation threshold and on-treatment target (<150 mm Hg). They simply weighed the positive SPRINT subgroup results in the 75 and older age cohort [11] less heavily than the aggregate body of other clinical trial data considered for older persons.

The ACC/AHA guideline recommended thiazide diuretics as one of four acceptable first-line drug therapies with no preference between thiazide and thiazide-like diuretics in patients without selected co-morbidities that would alter this recommendation. However, the AHA Scientific Statement on Resistant Hypertension [12] recommended the use of thiazide-like diuretics, chlorthalidone or indapamide, as preferred thiazide diuretics over HCTZ. Chlorthalidone has been compared to HCTZ directly and lowers BP more effectively [13], particularly at night, and has a much longer therapeutic half-life. Both chlorthalidone and indapamide have more CVD risk reduction data than HCTZ; thus, preferential use of thiazide-like diuretics in non-resistant hypertension also seems prudent.

There are major differences in the BP thresholds recommended for pharmacological treatment between the ACC/AHA, ESC/ESH [14], and Canadian yearly hypertension guidelines [15]. Not only do these two guidelines differ from the ACC/AHA guidelines but they also differ from each other. In patients without macrovascular target organ damage or other CVD risk factors, the Canadian yearly guideline recommends pharmacological therapy when DBP ≥ 100 or SBP ≥ 160 mm Hg. In patients with macrovascular target organ damage or other CVD risk factors, pharmacological treatment is recommended to be initiated when average DBP is ≥90 or SBP ≥ 140 mm Hg; target BP levels are <140/90 mm Hg. Initial treatment with either a single drug or single pill combination is recommended. Beta blockers are acceptable first-line drug therapy for those under 60 years of age. The ESC/ESH hypertension guideline recommends a BP treatment threshold of DBP ≥ 90 or SBP ≥ 140 mm Hg with ultimate treatment targets being <130/80 mm Hg; amongst those < 65 years, the SBP target is 120–129 mm Hg while in those 65 and older, the target is 130–139 systolic. Pharmacological treatment may be considered in the high-normal BP range (130–139/ 85–89) when CVD risk is very high, especially in those with known coronary artery disease. Two drug single-pill combination therapy is recommended for most except for the frail elderly and also in those at low risk with grade I hypertension (140–159/90–99 mm Hg) and SBP < 150 mmm Hg.

The 2010 International Society on Hypertension in Blacks (ISHIB) consensus statement [16] on treatment of hypertension in African Americans made several recommendations, for the first time, that were either incorporated in or adapted for subsequent guidelines/scientific statements. These recommendations include designating chlorthalidone as the preferred thiazide diuretic, using absolute CVD risk (Framingham risk score ≥20%) for treatment decisions in the absence of selected high-risk co-morbidities, and proffering a lower (135/85 mm Hg) than conventional BP treatment threshold and target in non-high risk hypertensives. Despite, at the time, being criticized, these recommendations proved prescient and ultimately somewhat conservative compared to the recommendations in the ACC/AHA hypertension guideline.

Though beyond the scope of this article, a strong case has been put forth justifying lower than conventional (<140/90 mm Hg) BP drug treatment thresholds and targets [17,18].

The landmark SPRINT trial demonstrated significant reductions in CVD events and all-cause mortality as well as in mild cognitive impairment, mild cognitive impairment + probable all-cause dementia, and lesser increases in brain white matter volume [19,20] in hypertensive individuals (SBP 130–180 mm Hg systolic with one additional CVD risk factor) randomized to a target SBP < 120 mm Hg compared to <140 mm Hg. Thus, an obvious question is why did the ACC/AHA hypertension guideline recommend a target BP < 130/80 instead of <120 mm Hg systolic for the majority of hypertensive patients? The most logical rationale was the wide perception that SPRINT measured BP not only using a standard protocol but that SPRINT BP measurements were unattended; unattended automated office BP readings are much lower than routine manual single office BP determinations [21]. However, fewer than 50% of SPRINT participants actually had unattended automated office BP readings (alone during the rest and BP measurement time period) [22]; BP at follow-up was virtually identical, 1–2 mm Hg differences, between attended and unattended BP measurement approaches. Also, there was no detectable difference in clinical benefit or risk for serious adverse events (SAEs) between these BP measurement approaches. However, the absence of a difference between attended and unattended BP measurement, for inexplicable reasons, differed from other published literature where double-digit differences in SBP have been observed (higher in attended BP measurements). Though post-SPRINT is the first time differences in research study and clinical practice BP measurements has been raised as an issue, attended research BP measurements have always been lower (~9/6 mm Hg) than manual single office BP determinations [21]. Thus, it appears that the ACC/AHA hypertension guideline BP target of <130/80 mm Hg was selected based on the pragmatic expectation that most clinics would not substantively alter their approach to BP measurement by implementing a rigorous BP measurement protocol. SPRINT data suggest the device and measurement protocol is more important than whether the BP measurement is attended or unattended. The magnitude of the difference in BP readings between routine clinical practice and research BP measurements (attended) is very similar to the difference between unattended automated office BP readings and those obtained in routine clinical practice [21,23].

Conclusion

The ACC/AHA hypertension guideline provides a comprehensive, sound approach to the diagnosis and treatment of hypertension in adults notwithstanding its differences from other excellent guidance in the ESC/ESH guideline. Clinical guideline groups have access to the same body of published data regarding virtually all aspects of hypertension diagnosis, management and therapeutics. Yet, a guideline may exclude certain data that other guidelines might include or may even consider the same data yet interpret and/or weight it different from another guideline writing group. Thus, recommendations made in key areas often differ, sometimes to a very substantive degree between excellent evidence-based guidelines.

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