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CLINICAL PRACTICE GUIDELINE

2025 AHA/ACC/AANP/AAPA/ABC/ACCP/ACPM/AGS/AMA/ASPC/NMA/PCNA/SGIM Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Developed in Collaboration With and Endorsed by American Academy of Physician Associates; American Association of Nurse Practitioners; American College of Clinical Pharmacy; American College of Preventive Medicine; American Geriatrics Society; American Medical Association; American Society of Preventive Cardiology; Association of Black Cardiologists; National Medical Association; Preventive Cardiovascular Nurses Association; and the Society of General Internal Medicine.

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4. PREVENTION STRATEGIES

Synopsis

The etiology of primary (previously termed essential) hypertension is a complex interplay of genetics, lifestyle choices, and chronic stress. Even in those with a genetic predisposition to hypertension, healthy lifestyle behaviors can prevent hypertension. All of the therapies recommended for the treatment of hypertension in Section 5.1 ("Lifestyle and Psychosocial Approaches") are useful in primordial prevention of hypertension and should be encouraged.[1] These include weight loss for those with overweight or obesity; a heart-healthy diet such as the DASH (Dietary Approaches to Stop Hypertension) eating plan; no more than 2,300 mg of sodium per day (with the ideal limit of no more than 1,500 mg per day for most adults); dietary potassium 3,500 to 5,000 mg per day; aerobic and resistance exercise (≥150 minutes of moderate physical activity per week and resistance exercise ≥2 days per week); and stress management practices. Intake of any alcohol is associated with higher SBP in a dose-response manner, including in individuals without hypertension.[2]

5. BP MANAGEMENT

5.1. Lifestyle and Psychosocial Approaches

Recommendations for Lifestyle and Psychosocial Approaches
Referenced studies that support the recommendations are summarized in the Evidence Table.

COR	LOE	RECOMMENDATIONS
		Weight
1	A	1. In adults who have overweight or obesity, weight loss is recommended with a goal of at least 5% of body weight reduction to prevent or treat elevated BP and hypertension.[1-9]
		Diet and Nutrients
1	A	2. In adults with or without hypertension, a heart-healthy eating pattern, such as the DASH eating plan, is recommended to prevent or treat elevated BP and hypertension.[9-15]
1	A	3. In adults with or without hypertension, reduction of dietary sodium intake* is recommended to <2,300 mg/d, moving toward an ideal limit of <1,500 mg/d to prevent or treat elevated BP and hypertension.[4,12,16-19]
2a	A	4. In adults with or without hypertension, potassium-based salt substitutes† can be useful to prevent or treat elevated BP and hypertension, particularly for patients in whom salt intake is related mostly to food preparation or flavoring at home, except in the presence of CKD or use of drugs that reduce potassium excretion where monitoring of serum potassium levels is indicated.‡[20-24]
1	A	5. In adults with elevated BP or hypertension, moderate potassium supplementation,§ ideally from dietary sources, is recommended to prevent or treat elevated BP and hypertension, except in the presence of CKD or use of drugs that reduce potassium excretion where monitoring of serum potassium levels is indicated.‡[25-27]
		Alcohol
1	A	6. Adults with or without hypertension who currently consume alcohol should be advised to pursue a recommended goal of abstinence, or at least to reduce alcohol intake to ≤1 drink/d for women and ≤2 drinks/d for men to prevent or treat elevated BP and hypertension.‖[28-31]
		Physical Activity
1	A	7. In adults with or without hypertension, increasing physical activity, through a structured exercise program that includes aerobic exercise and/or resistance training, is recommended to prevent or treat elevated BP and hypertension.[1,3,4,14,32-39]

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COR	LOE	RECOMMENDATIONS
		Stress Reduction
2b	B-R	8. In adults with or without hypertension, stress reduction through transcendental meditation may be reasonable to prevent or treat elevated BP and hypertension, as an adjunct to lifestyle or medication interventions.[7,8,14,40]
2b	B-R	9. In adults with or without hypertension, other forms of stress management, such as breathing control techniques or yoga, may be reasonable to prevent or treat elevated BP and hypertension, as an adjunct to lifestyle or medication interventions.[14,41,42]

*Dietary sodium reduction may be contraindicated in patients with severe, symptomatic orthostatic hypotension. †This recommendation refers to potassium-based salt substitutes, which typically contain 25% to 30% potassium chloride, 65% to 75% sodium chloride, and 0% to 10% flavoring agents. Products that refer to themselves as "salt substitutes" that do not contain potassium chloride as a substitute for sodium chloride have unknown effects on BP. ‡Drugs that reduce potassium excretion include: potassium-sparing diuretics (eg, amiloride, triamterene), mineralocorticoid receptor antagonists (eg, spironolactone, eplerenone, finerenone), angiotensin-converting enzyme inhibitors (eg, captopril, enalapril, lisinopril, benazepril, and others), angiotensin receptor blockers (eg, losartan, valsartan, candesartan, telmisartan, and others), and some immunosuppressive agents (eg, cyclosporine, tacrolimus). §Moderate potassium supplementation is <80 mmol/d (<80 mEq/d). ‖One standard drink (12 to 14 g alcohol) is equivalent to 12 oz of beer (5% alcohol by volume), 5 oz of wine (12% alcohol by volume), or 1.5 oz of distilled spirits (40% alcohol by volume).

Synopsis

BP tends to increase with age from young adulthood, with lifetime risks for incident hypertension exceeding 80% in U.S. populations.[43,44] Weight gain with age and adverse lifestyles (as defined by Life's Essential 8[45]), rather than aging per se, are potent drivers of BP increases over time.[46,47] Lifestyle modification approaches (**Table 12**) are critically important strategies to slow the increase in BP and delay or prevent the onset of hypertension. Once patients have been diagnosed with hypertension, specific lifestyle and nonpharmacological strategies can lower BP, slow progression of BP elevation, reduce the amount of medication needed to control BP, and prevent CVD events and mortality.[19-21,48,49] A Bayesian network meta-analysis assessed the comparative effectiveness of 22 lifestyle and stress-reduction strategies for BP lowering.[14] The DASH eating plan ranked as the most effective intervention for BP lowering, followed in order by aerobic exercise, isometric resistance training, low-sodium/high-potassium salt interventions, and comprehensive lifestyle interventions.[14] Meditation and breathing control appeared to be the most effective stress-reduction strategies that had at least moderate-quality evidence but were judged to be less effective than lifestyle interventions.[14] It is important to note that BP response to any given intervention will vary across subgroups and individuals and is a function of the fidelity and intensity of the intervention, patient adherence, and in some cases, the starting BP level.

Recommendation-Specific Supportive Text

1. In adults who have overweight or obesity (defined as body mass index [BMI] 25.0-29.9 and ≥30 kg/m^2 for non-Asian populations and BMI 23.0-27.4 and ≥27.5 kg/m^2 for individuals of Asian heritage[50]), weight loss is a core strategy to improve current health and reduce risk for multiple diseases, and for management of chronic conditions, including elevated BP and hypertension.[51,52] It is somewhat difficult to tease out the effects of weight loss per se on BP lowering from the means by which weight loss is achieved (ie, dietary changes and exercise, which have their own direct effects). Nonetheless, evidence consistently demonstrates BP reduction with weight loss regardless of the mechanism (lifestyle, cognitive behavioral therapy, medication, surgery).[7,9,10,53-55] In general, there is a reduction in BP of approximately 1/1 mm Hg (systolic/diastolic) for each 1 kg (2.2 lbs) of weight loss.[2] Weight reduction ≥5% of body weight or ≥3 kg/m^2 of BMI, compared with lesser amounts, produces greater BP lowering in patients with and without hypertension.[1,2,4-6,8-10,52] Weight loss can amplify the BP-lowering effects of the DASH diet or sodium reduction interventions.[1,4,9] For patients who do not meet weight loss goals with nonpharmacological interventions, pharmacotherapy[54,56] or bariatric surgery[53] can be considered; BP lowering correlates with the amount of weight loss using these approaches, although there is greater potential for adverse effects or harm.[53,57] In the short term, glucagon-like peptide-1 (GLP-1) receptor agonist medications used for other indications (diabetes, obesity) appear to provide concomitant BP lowering.[55,58-60]

TABLE 12 Lifestyle and Stress Reduction Interventions to Lower Blood Pressure

Intervention	Target/Biomarker	Evidence-Based Goals	Approximate Mean Change in SBP (mm Hg)*		References
			With Hypertension	Without Hypertension	
Weight loss	Body weight or BMI	Aim for sustained ≥5% reduction in body weight or ≥3 kg/m^2 reduction in BMI; expect about 1 mm Hg reduction for every 1-kg reduction in body weight	−6 to −8	−3 to −5	2,6,14,52
Heart-healthy diet	DASH eating pattern	Consume a diet rich in fruits, vegetables, whole grains, and low-fat dairy products, with reduced content of saturated and total fat	−5 to −8	−3 to −7	13-15,64,120
Reduced intake of sodium	Dietary sodium intake; 24-h urinary sodium	Optimal goal is <2,300 mg/d, but aim for an ideal limit of <1,500 mg/d	−6 to −8	−1 to −4	16-18,79,120,121
Use of salt substitute	Replace cooking/table salt (100% sodium chloride) with salt substitute (25%-30% potassium chloride, 65%-75% sodium chloride, and 0%-10% flavoring agents); 24-h urinary sodium and potassium	Reduce dietary sodium intake as above	−5 to −7	−5	20-22,93
Enhanced intake of potassium	Dietary potassium intake; 24-h urinary potassium	Aim for 3,500-5,000 mg/d, ideally by consumption of a diet rich in potassium; or alternative use of moderate-dose pharmacological potassium supplementation (<80 mmol)	−6	−3 to −6	25-27
Reduced alcohol intake	Alcohol consumption	Optimal goal is abstinence for all adults for best health outcomes; in patients who consume alcohol, aim for >50% reduction in daily intake to no more than 2 drinks/d in men or 1 drink/d in women	−4 to −6	−3	29
Exercise	Aerobic exercise	90-150 min/wk 65%-75% heart rate reserve	−4 to −8	−2 to −7	14,33,36,120,122
	Dynamic resistance	90-150 min/wk 50%-80% 1 rep maximum 6 exercises, 3 sets/exercise, 10 repetitions/set	−2 to −7	−2 to −5	33,36,106,107
	Isometric resistance	4 × 2 min (hand grip), 1 min rest between exercises, 30%-40% maximum voluntary contraction, 3 sessions/wk	−5 to −10	−4 to −6	14,32,33,36,109,110
Meditation	Transcendental meditation	Training by a professional, followed by 2 × 20 min sessions/d while seated comfortably with eyes closed	−5 to −7	−5	14,119
Breathing control	Slowing respiration	Device-guided session to decrease respiration to <10 breaths/min for 15 min/d	−5	−5	14

*Because inclusion/exclusion criteria and comparator groups vary across interventions, these values should not be compared directly to indicate comparative effectiveness. Modified with permission from Whelton et al.[123] Copyright 2018 American College of Cardiology Foundation and American Heart Association, Inc.

BMI indicates body mass index; DASH, Dietary Approaches to Stop Hypertension; and SBP, systolic blood pressure.

2. The DASH eating plan emphasizes fruits, vegetables, low-fat or nonfat dairy, and whole grains, providing high potassium, magnesium, calcium, and fiber intake.[61] It is the most effective eating pattern for lowering BP and has a large and consistent evidence base across BP levels.[10-15,61-64] Conversely, the eating pattern in the Southern United States appears to be the largest mediator of the higher hypertension incidence in Black adults compared with White adults.[65] Reduction in BP with the DASH eating plan varies across trials, from 1 to 13 mm Hg for SBP and from 1 to 10 mm Hg for DBP. BP reduction with the DASH eating plan is generally greater among Black individuals[66] and individuals with higher baseline BP, younger age (<50 years), or higher sodium intake (>2,400 mg/d).[13,63] The DASH eating plan has been effective in both short-term feeding and longer-term behavioral intervention studies,[9-11] and the effect on BP is significantly greater when combined with weight loss or sodium reduction.[9,10,12] Patient information regarding the DASH eating plan is available publicly.[67-69] Counseling by a registered dietician/nutritionist is useful to enhance efficacy.[70] Other eating patterns, including Mediterranean, low-carbohydrate, Paleolithic, high-protein, vegetarian, low-glycemic index, low-sodium, and low-fat dietary approaches, have been shown to lower

BP when compared with various control diets, although less effectively than the DASH eating plan.[14,15,64,71-74]

3. Interventions that decrease sodium intake reduce BP elevation across the life course, prevent incident hypertension, and lower BP in adults with hypertension.[17,18,20,22-24,75-87] Sodium substitution interventions prevent CVD events and mortality,[20,21] and dietary interventions that reduce sodium appear to do the same.[19,48,49] There is a linear dose response of BP to sodium intake manipulation, with steeper BP declines at higher than lower baseline BP levels.[17,18,77] On average, low-sodium (≤1,500-2,300 mg/d) versus high-sodium (≥4,500 mg/d) diets safely result in BP reductions of approximately 3/2 mm Hg (systolic/diastolic) in normotensive and 7/3 mm Hg in hypertensive individuals.[4,5,10,16,18] There is greater responsiveness to sodium reduction in older adults and those with salt-sensitive BP.[18,77,86-88] Sodium reduction has additive BP-lowering effects to the DASH eating plan and weight loss.[4,12] Behavioral interventions targeting lower sodium intake, especially if advice is provided by a registered dietitian or low-sodium meals are provided, are most effective in sodium reduction.[22,70,76,78,79,82,83] In the United States, most dietary sodium comes from additions during food processing or during food preparation in restaurants,[89-91] so successful reduction at the population level requires not just a focus on individual behaviors but on societal changes in eating patterns and broad food reformulation strategies and policies.[81] Such population-level strategies could have a profound impact on CVD event reduction.[92]
4. Compared with the use of regular table salt, use of a potassium-enriched salt substitute (in which 100% sodium chloride is partially replaced by potassium chloride and, variably, flavoring agents) causes approximately a 5/1.5 mm Hg (systolic/diastolic) reduction with variability depending on the subgroup and the amount of sodium replacement.[20,22-24,93] In the largest trial to date, 20,995 adults in China, with either a history of stroke or age ≥60 years and uncontrolled BP, were enrolled in a cluster-randomized trial comparing a salt substitute (75% sodium chloride/25% potassium chloride) with regular salt. Use of the salt substitute was associated with SBP reduction by 3.3 mm Hg and significant relative reductions in stroke, MACE, and all-cause mortality of 12% to 14%, with no increase in risk for hyperkalemia.[21] Although most of the data on salt substitutes come from trials performed in East Asia, no significant heterogeneity of effect has been seen by global region.[93,94] Because in the United States the majority of sodium intake comes from consumption of processed foods or meals prepared in restaurants,[89-91] use of a salt substitute may be of greatest benefit in individuals who consume most of their sodium at home, from salt added during food preparation or at the table. Limitations to use of salt substitutes include low availability in the United States of potassium-enriched salt substitutes in the ratios studied to date, potential concerns over taste, and the potential for hyperkalemia in individuals with CKD and those using drugs that reduce potassium excretion (eg, potassium-sparing diuretics).
5. Observational studies have consistently demonstrated that individuals with higher dietary intake of potassium-rich foods (from natural sources such as fruits, juices, vegetables, and legumes) and/or a lower urinary sodium to potassium ratio have lower BP levels and lower stroke and mortality rates.[95-100] Accordingly, a number of studies have examined the effect of potassium supplementation on BP. Moderate potassium supplementation, on average, lowers BP by 6/4 mm Hg, with variation in effects on BP by potassium dose, sodium intake, presence of hypertension, and use of antihypertensive medication.[16,26,27] The BP-lowering effects are greater among participants with hypertension and those with higher urinary sodium excretion (greater intake) at baseline, especially ≥4,000 mg/day. There appears to be a U-shaped relationship between potassium supplementation and BP levels, with maximal lowering of BP at approximately 30 mmol/day supplementation and an increase in BP above 80 mmol/day supplementation. The BP increase at higher doses of potassium supplementation (>80 mmol/day) is most evident in those taking antihypertensive therapy.[26]
6. SBP and DBP increase over time with any amount of baseline alcohol intake. Compared with average alcohol intake of 12 g per day (1 standard drink), relative risks for hypertension incidence among individuals drinking 0, 24, 36, and 48 g per day were 0.89 (95% CI: 0.84-0.94), 1.11 (95% CI: 1.07-1.15), 1.22 (95% CI: 1.14-1.30), and 1.33 (95% CI: 1.18-1.49), respectively. Thus, risk for incident hypertension is lowest for those who abstain.[101] Among normotensive individuals who consume alcohol enrolled in controlled trials, reduction of alcohol intake by at least 50% or to abstinence is associated with BP reduction, especially for those drinking ≥4 drinks per day.[29] For patients with hypertension, BP reduction is correlated with the percent reduction in alcohol intake and is greater for those with higher baseline intake.[28-31,102,103] Among individuals with alcohol

intake ≥6 drinks per day who reduced intake by 50% on average, mean BP was lowered by 5.5/4.0 mm Hg. Reductions were significant but lower for participants with a baseline intake of 3 to 5 drinks per day. At ≤2 drinks per day, there was no significant reduction in BP observed with reduction of alcohol intake.[29] There are no harms identified with alcohol reduction, but continued alcohol intake is associated with other noncardiovascular harm. Prior observational studies suggesting health benefits with moderate alcohol intake appear to be partially confounded by other positive health factors and socioeconomic position and offset by other health risks.[104] Thus, aiming for abstinence appears to be optimal.[91,104]

7. Increasing leisure-time physical activity reduces BP significantly in adults with hypertension,[39] and it has been an intrinsic component of weight reduction interventions used to reduce BP in patients with and without hypertension.[1,3,4] Structured exercise programs that involve aerobic exercise (eg, endurance activities such as jogging[14,33,35-37,105]), dynamic resistance (eg, weight lifting[14,33,36,106,107]), and static/isometric resistance training (eg, handgrip[14,32-34,36,108-110]) appear particularly effective for BP lowering in adults with or without hypertension. Even lower-intensity physical activity (eg, walking) that interrupts sedentary time can reduce BP.[111-116] All types of structured exercise also appear to be safe, even for older adults with hypertension. Aerobic exercise reduces SBP on average by 4 to 7/3 to 4 mm Hg, with a slightly larger effect in patients with versus without hypertension.[14,33,35] There is a dose response, with an average 2/1 mm Hg reduction for each additional 30 minutes of aerobic exercise per week and the largest BP reduction at 150 minutes per week.[37] Dynamic resistance training alone appears to have a more modest effect on BP reduction (3/2 mm Hg) than aerobic exercise, with larger reductions in people with hypertension versus without.[14,33,36,106,107] Isometric exercise may have the largest effect on BP reduction (mean reductions of approximately 8/4 mm Hg).[14,32-34,36,108-110] Combination training with aerobic and resistance exercise appears similarly efficacious as either alone.[33,36,38] BP-lowering effects are observed for lower- and higher-intensity exercise and with continuous and interval training.[33,38,106,117,118]
8. A number of stress-reduction strategies have been assessed for their effect on BP lowering.[119] There is consistent moderate- to high-level evidence from short-term clinical trials that transcendental meditation can lower BP in patients without and with hypertension, with mean reductions of approximately 5/2 mm Hg in SBP/DBP.[14,40] Meditation appears to be somewhat less effective than BP-lowering lifestyle interventions, such as the DASH eating plan, structured exercise programs, or low-sodium/higher-potassium intake.[14] The study designs and means of teaching and practicing meditation interventions are heterogeneous across trials, and trials have been of smaller size and short duration, so further data would be beneficial.
9. Among other stress-reducing and mindfulness-based interventions, data are less robust, and evidence is of lower quality because of smaller, short-term trials with heterogenous interventions and results. There is moderate-grade evidence that breathing control interventions lower SBP/DBP by approximately 5/3 mm Hg in people with and without hypertension.[14] There is also low- to moderate-grade evidence that yoga of diverse types lowers BP.[14,41,42]

5.2. Medical Management

Synopsis

Throughout this guideline, we use the term thiazide-type diuretic to collectively refer to HCTZ, chlorthalidone, and indapamide. Although the literature traditionally differentiates these medications based on their chemical structures, categorizing HCTZ as a thiazide-type diuretic because it possesses a benzothiadiazine ring and categorizing chlorthalidone and indapamide as thiazide-like diuretics because they lack this ring (yet remain closely related sulfonamide derivatives), the interchangeability of thiazide-type and -like agents remains a debated topic. For simplicity and to minimize confusion, in this guideline we have chosen to group them under a single term. In most settings, it is acceptable for clinicians to choose among these agents for treatment. We recognize there are differences in potency and half-life between these agents that may be relevant in some situations, particularly in the management of resistant hypertension (Section 5.6, "Resistant Hypertension"). In that setting, thiazide-like diuretics are preferred due to their greater efficacy; therefore, treatment recommendations in this setting continue to advocate thiazide-like diuretics.

5.2.1. Initiation of Pharmacologic BP Treatment in the Context of Overall CVD Risk

Synopsis

Evidence from meta-analyses of clinical trial data, large observational studies, and simulation models has consistently shown the benefits of antihypertensive therapy initiation can be maximized by prioritizing those at highest cardiovascular risk with the use of absolute risk estimation.[1-7] Although the public health burden is significant at stage 1 hypertension and many will progress to stage 2 hypertension with associated risk,[8] the BP

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