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Treatment of Hypertension

In 2013, the JNC 8 panel released recommendations based solely on RCTs and addressed three clinical questions: what is the blood pressure threshold for starting pharmacotherapy, what are the blood pressure goals, and which antihypertensives improve health outcomes.[1] Also in late 2013, the American Society of Hypertension (ASH) in collaboration with the International Society of Hypertension released their own expert opinion summary aimed at prescribers' "real-life" practice settings.[2] **ASH now aligns with the AHA**. The 2017 ACC/AHA guidelines are based on RCTs and other evidence (systematic reviews, etc).[6] But the **American Academy of Family Practice endorses JNC 8**, not the ACC/AHA guidelines.[13] The chart below summarizes the latest guidelines, with select additional supporting information. Note that blood pressure control on **hypertensive crises**, **acute intracranial hemorrhage**, and **acute ischemic stroke** are beyond the scope this chart, but are covered in the ACC/AHA guidelines (available at http://hyper.ahajournals.org/content/early/2017/11/10/HYP.0000000000000065). For antihypertensive dosing information and more, see our charts *ACE Inhibitor Antihypertensive Dose Comparison*, *Comparison of Angiotensin Receptor Blockers*, *Comparison of Commonly Used Diuretics*, *Antihypertensive Combinations*, *Comparison of Calcium Channel Blockers*, and *Comparison of Oral Beta-Blockers*. For your patients, get our patient education handouts, *Blood Pressure Medications and You* and *How to Eat a Heart-Healthy Diet*.

Abbreviations: ACC = American College of Cardiology; ACEI = angiotensin-converting enzyme inhibitor; ACS = acute coronary syndrome; AHA = American Heart Association; ARB = angiotensin receptor blocker; ASH = American Society of Hypertension; BB = beta-blocker; CAD = coronary artery disease; CCB = calcium channel blocker; CKD = chronic kidney disease; DBP = diastolic blood pressure; HF = heart failure; HF*p*EF = heart failure with preserved ejection fraction; HF*r*EF = heart failure with reduced ejection fraction; HTN = hypertension; ISH = isolated systolic hypertension; MI = myocardial infarction; JNC 8 = Eighth Joint National Committee; RCT = randomized controlled trial; SBP = systolic blood pressure

ACC/AHA	JNC 8 Panel	International Society of Hypertension
What lifestyle changes are recommended to reduce cardiovascular risk?		
• Weight loss.[6] (1 kg weight loss can reduce SBP by 1 mmHg.)[6] • Heart-healthy diet (e.g., DASH dietary pattern can reduce SBP by 11 mmHg).[6] • Dietary sodium reduction (e.g., cut by 25% or 1,000 mg/day to reduce SBP by 5 mmHg).[6] • Increase dietary potassium (e.g., 4 to 5 servings of fruits and vegetables/day).[6] • Structured exercise program.[6] (150 min. aerobic activity/week can reduce SBP by 5 mmHg.)[6] • Reduce alcohol intake to one (women) or two (men) drinks daily.[6]	• Supports 2013 AHA/ACC lifestyle recommendations.[1] See our chart, *Lifestyle Changes to Reduce Cardiovascular Risk.*	• At least modest weight loss for overweight or obese patients.[2] Increase fruits and vegetables.[2] • Dietary sodium reduction. Educate patients about salt content of processed foods.[2] • Increase dietary potassium.[2] • Regular aerobic exercise.[2] At minimum, integrate activity in daily routine (e.g., ride bike, take stairs).[2] • Reduce alcohol intake to one (women) or two (men) drinks daily.[2] • Smoking cessation (for cardiovascular health, not treatment of hypertension).[2]

More. . .

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How should blood pressure be measured? (For details, see our chart, *Blood Pressure Monitoring*.)		
• Blood pressure should be measured after the patient has emptied their bladder and has been seated for >five minutes with back supported and legs resting on the ground (not crossed).[6] • Arm should be supported (e.g., resting on table).[6] • Position correct-size cuff at the level of the right atrium (midpoint of sternum).[6] • Use a validated device.[6] • Take two readings one to two minutes apart, and average the readings.[6] • Measure blood pressure in both arms at initial evaluation. Use the higher reading for measurements thereafter.[6] • Change in BP from seated to standing position should be measured to detect orthostatic hypotension (a decline >20 mmHg in SBP or >10 mmHg in DBP after 1 minute is abnormal).[6]	• Not addressed (not a focus of the guidelines).	• Blood pressure should be measured after the patient has emptied their bladder and has been seated for five minutes with back supported and legs resting on the ground (not crossed).[2] • Arm used for measurement should rest on a table, at heart-level.[2] • Use a sphygmomanometer/stethoscope or automated electronic device (preferred) with the correct size arm cuff.[2] • Take two readings one to two minutes apart, and average the readings (preferred).[2] • Measure blood pressure in both arms at initial evaluation. Use the higher reading for measurements thereafter.[2] • Consider checking standing readings after one and three minutes to screen for orthostatic hypotension, especially in the elderly.[2]
How is hypertension diagnosed?		
• Use an average of two or three measurements taken on two or three separate visits.[6] • Consider home blood pressure monitoring or ambulatory blood pressure monitoring if white coat HTN is suspected in adults with untreated SBP >130 mmHg but <160 mmHg or DBP >80 mmHg but <100 mmHg.[6]	• Not addressed (not a focus of the guidelines).	• Confirm the diagnosis of HTN at a subsequent visit one to four weeks after the first.[2] If blood pressure is very high (e.g., systolic 180 mmHg or higher), or timely follow-up unrealistic, treatment can be started after just one set of measurements.[2] • Consider home blood pressure monitoring or ambulatory blood pressure monitoring if white coat HTN is suspected.[2]

More. . .

ACC/AHA	JNC 8 Panel	International Society of Hypertension
Who should be treated with pharmacotherapy?		
• Patients with **clinical cardiovascular disease** (e.g., stable ischemic heart disease, peripheral artery disease) or **10-year atherosclerotic cardiovascular disease risk 10% or higher**: start pharmacotherapy at 130/80 mmHg.[6] • Patients with **heart failure**: start pharmacotherapy at 130/80 mm Hg.[6] Post-**stroke, BP 140/90 mmHg or higher, but without previously diagnosed or treated HTN**: start pharmacotherapy 72 hours after symptom onset and stable neurological status or TIA (benefit of pharmacotherapy not established if BP <140/90 mmHg).[6] • Post-**stroke or TIA, with previously diagnosed or treated HTN**: restart pharmacotherapy 72 hours after symptom onset and stable neurological status or TIA.[6] • Patients with **no history of cardiovascular disease** and **10-year atherosclerotic cardiovascular disease risk <10%**: start pharmacotherapy at 140/90 mmHg.[6] • Patients **65 years of age and older**, community-dwelling, ambulatory: start pharmacotherapy at SBP 130 mmHg.[6] • Patients with **diabetes**: start pharmacotherapy at 130/80 mmHg.[6] • Patients with **chronic kidney disease** (including post-renal transplant): start pharmacotherapy at 130/80 mmHg.[6]	• Patients **<60 years of age**: start pharmacotherapy at 140/90 mmHg.[1] • Patients with **diabetes**: start pharmacotherapy at 140/90 mmHg.[1] • Patients with **CKD**: start pharmacotherapy at 140/90 mmHg.[1] • Patients **60 years of age and older**: start pharmacotherapy at 150/90 mmHg.[1]	• **Patients younger than 80 years of age**: start pharmacotherapy at 140/90 mmHg[2] • **Patients 80 years of age and up**: start pharmacotherapy at 150/90 mmHg.[2] Consider starting at 140/90 mmHg in those with diabetes or CKD.[2] • **Patients with uncomplicated stage 1 HTN**: (140 to 159/90 to 99 mmHg without CV abnormalities or risk factors): consider six to 12 months of lifestyle changes (e.g., weight loss, sodium restriction, exercise, smoking cessation) alone before pharmacotherapy.[2] • Continue lifestyle changes in addition to pharmacotherapy.[2]

More. . .

ACC/AHA	JNC 8 Panel	International Society of Hypertension
What is the goal blood pressure?		

• **Most patients**: <130/80 mmHg[6]
• **Elderly**
  • 65 years of age and older, community-dwelling, ambulatory: SBP <130 mmHg.[6]
  • Use clinical judgement and consider patient preference in patients with multiple comorbidities, falls, dementia, inability to live independently, orthostasis, Parkinson's disease, or limited life expectancy.[6]
• Post-**stroke or TIA, BP 140/90 mmHg or higher, but without previously diagnosed or treated HTN**: <130/80 mmHg.[6] Post-**stroke**, **with previously diagnosed or treated HTN**: <140/90 mmHg
• **Lacunar stroke**: SBP <130 mmHg.[6]
 	
NOTE: lower goals vs JNC 8 influenced by results of SPRINT.
	• Patients **<60 years of age**: <140/90 mmHg[1]
	• Patients with **diabetes**: <140/90 mmHg [Evidence level A-1][7-10]
	• Patients with **CKD**: <140/90 mmHg[1]
	• Patients **60 years of age and older**: <150/90 mmHg [Evidence level B-1].[4,5] But no need to back off on tolerated treatment if lower systolic (e.g., <140 mmHg) achieved.[1]
	• Use clinical judgment; consider risk/benefit of treatment for each individual when setting goal.[1]
		• **Patients younger than 80 years of age**: <140/90 mmHg[2]
		• **Patients 80 years of age and up**: systolic of up to 150 mmHg is acceptable [Evidence level A; high-quality RCT].[3] A goal of <140/90 mmHg can be considered for those with diabetes or CKD.[2]
		• **Patients 18 to 55 years of age**: lower target (e.g., <130/80 mmHg) can be considered, per prescriber discretion, if treatment is tolerated.[2] However, evidence of additional benefit vs goal of <140/90 mmHg is lacking.[2]
		• **CKD with albuminuria**: some experts recommend <130/80 mmHg.[2]
		• Unproven clinical benefit of lower targets previously recommended in diabetes, CKD, and CAD.[2]

What pharmacotherapy is recommended?		

• **First-line agents** include thiazides (chlorthalidone preferred due to duration of action and positive outcomes data), CCB, ACEI, or ARBs.[6]
• Most adults will need at least two antihypertensives to reach <130/80 mmHg, especially African Americans.[6] Initiate with two agents if systolic >20 mmHg above goal or diastolic >10 mmHg above goal.[6] Use caution in the elderly.[6]
 	
Continued…
	• **Nonblack**, including those with diabetes: thiazide, CCB, ACEI, or ARB[1]
	• **African American**, including those with diabetes: thiazide or CCB.[1] African Americans have high stroke risk.[11] CCBs provide better stroke prevention and blood pressure reduction in African Americans vs ACEIs.[1] Thiazides produce better CV outcomes (including reduced stroke risk) than ACEIs in African Americans.[1]
	• **CKD**: regimen should include an ACEI or ARB (including African Americans)[1]
	• Can initiate with two agents, especially if systolic >20 mmHg above goal or diastolic
		• **Nonblack <60 years of age**:[2]
		  • **First-line**: ACEI or ARB
		  • **Second-line** (add-on): CCB or thiazide
		  • **Third-line**: CCB plus ACEI or ARB plus thiazide
		• **Nonblack 60 years of age and older**:[2]
		  • **First-line**: CCB or thiazide preferred, ACEI, or ARB
		  • **Second-line** (add-on): CCB, thiazide, ACEI, or ARB (don't use ACEI plus ARB)
		  • **Third-line**: CCB plus ACEI or ARB plus thiazide
		• **African American**:[2]
		  • **First-line**: CCB or thiazide. African

More. . .

ACC/AHA	JNC 8 Panel	International Society of Hypertension
What pharmacotherapy is recommended, continued		

• **Stable ischemic heart disease**: first-line, evidence-based BB, ACEI, or ARB. If needed, add dihydropyridine CCB (especially for angina despite BB), thiazide, and/or mineralocorticoid blocker.[6]
  • Can continue BB and/or CCB beyond three years post-MI or ACS for treatment of hypertension without HF*r*EF.[6]
  • BB choices include carvedilol, metoprolol, nadolol, bisoprolol, propranolol, or timolol. Avoid atenolol; it does not reduce CV events.[6]
• **HF*r*EF**: do not use a non-dihydropyridine CCB (diltiazem, verapamil).[6] Amlodipine or felodipine can be used.[6] Preferred BBs are metoprolol succinate, bisoprolol, and carvedilol.[6]
• **HF*p*EF**: diuretic for volume overload. If needed, add an ACEI or ARB and BB.[6]
• **Diabetes**: thiazide, ACEI, ARB, or CCB (ACEI or ARB with albuminuria)[6]
• **African Americans** without HF or chronic kidney disease: first-line treatment should include a thiazide (chlorthalidone) for optimum endpoint protection in blacks.[6] African Americans and nonblacks have similar responses to combination therapy (i.e., thiazide plus ACEI; CCB plus ACEI).[6]
• **Chronic kidney disease** (stage 3 or higher or albuminuria): ACEI (or ARB if ACEI not tolerated) is reasonable to slow progression[6]
• **Thoracic aortic disease**: beta-blockers[6]
Continued…
	>10 mmHg above goal.[1]
	
	Notes:
	• If goal not reached:[1]
	  • stress adherence to medication and lifestyle
	  • increase dose or add a second or third agent from one of the recommended classes.
	  • choose a drug outside of the classes recommended above only if these options have been exhausted. Consider specialist referral.
	• Do ***not*** use an ACEI plus an ARB; no added benefit, more side effects (e.g., hyperkalemia).[2,12]
	• Pivotal studies showing clinical benefits of treating HTN included a thiazide.[1]
		Americans tend to be "salt-sensitive."[2] This may explain their relatively poor response to ACEIs.[2] Most African Americans will need at least two antihypertensives to control blood pressure.[11] African Americans and nonblacks have similar responses to combination therapy (i.e., thiazide plus ACEI; CCB plus ACEI).[2]
		  • **Second-line (add-on)**: ACEI or ARB
		  • **Third-line**: CCB plus ACEI or ARB plus thiazide
		• **Diabetes**:[2]
		  • **First-line**: ACEI or ARB [Evidence level C; consensus] (can start with CCB or thiazide in African Americans). Because patients with diabetes are at increased risk of nephropathy, coronary artery disease, and heart failure, conditions known to benefit from ACEIs and ARBs, it makes sense to choose one of them first-line for hypertension in patients with diabetes.[3]
		  • **Second-line**: add CCB or thiazide (can add ACEI or ARB in African Americans)
		  • **Third-line**: CCB plus ACEI or ARB plus thiazide
		• **CKD**:[2]
		  • **First-line**: ARB or ACEI (ACEI for African Americans)
		  • **Second-line (add-on)**: CCB or thiazide
		  • **Third-line**: CCB plus ACEI or ARB plus thiazide

More. . .

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What pharmacotherapy is recommended, continued		

• **Stroke or TIA**: thiazide, ACEI, or ARB, or thiazide plus ACEI, but consider comorbidities.[6]
• **Atrial fibrillation**: ARB[6]
• **Pregnancy, or planning a pregnancy**: transition to methyldopa, nifedipine, and/or labetalol. Avoid ACEI, ARB, or aliskiren.[6]
• **Renal transplant**: CCB[6]
• **Resistant hypertension** (patient prescribed three or more optimized antihypertensives): optimize diuretic, add mineralocorticoid, add loop diuretic in chronic kidney disease or patient taking potent vasodilator such as minoxidil, add other agents with different mechanisms (after considering pseudoresistance, lifestyle factors, contributing drugs/supplements, secondary hypertension).[6]
 	
Notes:
• Do ***not*** use an ACEI plus an ARB and/or aliskiren; no added benefit, more side effects (e.g., hyperkalemia).[6,12]
• Avoid antihypertensives that slow the heart rate in patients with chronic **aortic valve insufficiency**.[6]
		• **CAD**:[2]
		  • **First-line**: BB plus ARB or ACEI
		  • **Second-line (add-on)**: CCB or thiazide
		  • **Third-line**: BB plus ARB or ACEI plus CCB plus thiazide
		• **Stroke history**:[2]
		  • **First-line**: ACEI or ARB
		  • **Second-line**: add CCB or thiazide
		  • **Third-line**: CCB plus ACEI or ARB plus thiazide
		• **Heart failure**:[2] ACEI or ARB plus BB plus diuretic plus aldosterone antagonist. Amlodipine can be added for additional BP control.
		
		Notes:
		• Choose once-daily or combination products to simplify the regimen.[2]
		• In general, wait two to three weeks before increasing dose or adding new drug.[2]
		• Consider chlorthalidone or indapamide over hydrochlorothiazide due to better evidence of benefit.[2]
		• For HTN, beta- and alpha-blockers have worse CV outcomes data than the recommended agents.[1]
		• Do ***not*** use an ACEI plus an ARB; no added benefit, more side effects (e.g., hyperkalemia).[2,12]

More. . .

Levels of Evidence

In accordance with our goal of providing Evidence-Based information, we are citing the **LEVEL OF EVIDENCE** for the clinical recommendations we publish.

Level	Definition	Study Quality
A	Good-quality patient-oriented evidence.*	1. High-quality RCT 2. SR/Meta-analysis of RCTs with consistent findings 3. All-or-none study
B	Inconsistent or limited-quality patient-oriented evidence.*	1. Lower-quality RCT 2. SR/Meta-analysis with low-quality clinical trials or of studies with inconsistent findings 3. Cohort study 4. Case control study
C	Consensus; usual practice; expert opinion; disease-oriented evidence (e.g., physiologic or surrogate endpoints); case series for studies of diagnosis, treatment, prevention, or screening.	

***Outcomes that matter to patients** (e.g., morbidity, mortality, symptom improvement, quality of life).
RCT = randomized controlled trial; **SR** = systematic review
[Adapted from Ebell MH, Siwek J, Weiss BD, et al. Strength of Recommendation Taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. *Am Fam Physician* 2004;69:548-56. http://www.aafp.org/afp/2004/0201/p548.pdf.]

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