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Treatment of Hypertension

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Abstract

Automated validated devices should be used to measure blood pressure (BP). A systolic BP between 120–129 mm Hg with a diastolic BP < 80 mm Hg should be treated by lifestyle measures. Treat with lifestyle measures plus BP lowering drugs for secondary prevention of recurrent cardiovascular disease events in patients with clinical cardiovascular disease (coronary heart disease, congestive heart failure, and stroke) and an average systolic BP of ≥130 mm Hg or an average diastolic BP ≥ 80 mm Hg. Treat with lifestyle measures plus BP lowering drugs for primary prevention of cardiovascular disease in patients with an estimated 10-year risk of atherosclerotic cardiovascular disease ≥ 10 % and an average systolic BP ≥130 mm Hg or an average diastolic BP ≥80 mm Hg. Treat with lifestyle measures plus BP lowering drugs for primary prevention of cardiovascular disease in patients with an estimated 10-year risk of atherosclerotic cardiovascular disease of < 10 % and an average systolic BP ≥140 mm Hg or an average diastolic BP ≥ 90 mm Hg. Treat with antihypertensive drug therapy with 2 first-line drugs from different classes either as separate agents or in a fixed-dose combination in patients with a BP ≥140/90 mm Hg or with a BP > 20/10 mm Hg above their blood pressure target. White coat hypertension must be excluded before starting treatment with antihypertensive drugs in patients with hypertension at low risk for atherosclerotic cardiovascular disease. Antihypertensive drug therapy for different disorders is discussed.

Keywords

Hypertension; systolic blood pressure; diastolic blood pressure; antihypertensive drugs; lifestyle measures

INTRODUCTION

Hypertension is the most common modifiable risk factor for cardiovascular events and mortality in the world. [1] The prevalence of hypertension is 69 % in persons with a first myocardial infarction [2, 77 % in persons with a first stroke [2, 74 % in persons with congestive heart failure [2, and 60 % in persons with peripheral arterial disease. [3] Hypertension is also a major risk factor for sudden cardiac death, a dissecting aortic aneurysm, angina pectoris, left ventricular hypertrophy, thoracic and abdominal aortic aneurysms, chronic kidney disease, atrial fibrillation,

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diabetes mellitus, the metabolic syndrome, vascular dementia, Alzheimer's disease, and ophthalmologic disease [4]. A meta-analysis of 61 prospective studies with 1 million persons without prior cardiovascular disease demonstrated that cardiovascular risk increases progressively from a blood pressure level of 115/75 mm Hg with a doubling of the incidence of coronary heart disease and of stroke for every 20/10 mm Hg increase [5]. Numerous randomized prospective, double-blind, placebo-controlled studies have shown that antihypertensive drug treatment reduces cardiovascular events and mortality [4 ,6.10].

2017 ACC/AHA HYPERTENSION GUIDELINES

The 2017 United States hypertension guidelines were written by members from 11 professional societies. [11] These guidelines stated that common modifiable risk factors present in persons who have hypertension are current cigarette smoking, passive smoking, diabetes mellitus, dyslipidemia/hypercholesterolemia, overweight/obesity, physical inactivity/low fitness, and unhealthy diet [11].

The new 2017 hypertension guidelines reported that a normal blood pressure is below 120/80 mm Hg. [11] An elevated blood pressure is 120–129/<80 mm Hg. Stage 1 hypertension is a systolic blood pressure of 130–139 mm Hg or a diastolic blood pressure of 80–89 mm Hg. Stage 2 hypertension is a systolic blood pressure of 140 mm Hg and higher or a diastolic blood pressure of 90 mm Hg and higher [11]. Automated validated devices should be used to measure blood pressure. Using these new criteria, the prevalence of hypertension in the United States of America is 31 % of men and 18 % of women aged 20 to 44 years, 52 % of men and 46 % of women aged 45 to 54 years, 68 % of men and 65 % of women aged 55 to 64 years of age, 75 % of men and 78 % of women aged 65 to 74 years of age, and 83 % of men 86 % of women aged 75 years and older [11]. The overall prevalence of hypertension in the United States of america is 49 % in non-Hispanic white men and 47 % in nonHispanic white women, 59 % in non-Hispanic African-American men and 60 % in non-Hispanic African-American women, and 46 % in Hispanic men and 41 % in Hispanic women [11].

These hypertension guidelines also reported that the absolute cardiovascular risk reduction caused by blood pressure lowering is greater at higher absolute levels of cardiovascular disease risk [11]. Antihypertensive drug therapy should be guided by predicted cardiovascular disease risk in conjunction with blood pressure. [11–14] Hypertensive persons with a 10-year atherosclerotic cardiovascular risk less than 15 % with a systolic blood pressure between 120–159 mm Hg and a coronary artery calcium score greater than 100 also have an increased risk for cardiovascular events and should be considered for intensive blood pressure lowering [15].

A systolic blood pressure between 120–129 mm Hg with a diastolic blood pressure below 80 mm Hg should be managed by lifestyle measures. [11, [16] Persons with an untreated systolic blood pressure between 131–159 mm Hg or a diastolic blood pressure between 81–99 mm Hg, should be screened for white coat hypertension using either daytime ambulatory blood pressure monitoring or home blood pressure monitoring [11, 17].

The new hypertension guidelines recommended lifestyle measures plus blood pressure lowering drugs for secondary prevention of recurrent cardiovascular disease events in persons with clinical cardiovascular disease (coronary heart disease, congestive heart failure, and stroke) and an average systolic blood pressure of 130 mm Hg and higher or an average diastolic blood pressure of 80 mm Hg and higher [11, 18, 19]. These guidelines recommended lifestyle measures plus blood pressure lowering drugs for primary prevention of cardiovascular disease in persons with an estimated 10-year risk of atherosclerotic cardiovascular disease ⩾10 % [20] and an average systolic blood pressure of 130 mm Hg and higher or an average diastolic blood pressure of 80 mm Hg and higher [11, 21]. These guidelines recommended lifestyle measures plus blood pressure lowering drugs for primary prevention of cardiovascular disease in persons with an estimated 10-year risk of atherosclerotic cardiovascular disease of < 10 % [20] and an average systolic blood pressure of 140 mm Hg and higher or an average diastolic blood pressure of 90 mm Hg and higher [5, 11, 21]. These guidelines recommended treatment with antihypertensive drug therapy with 2 first-line drugs from different classes either as separate agents or in a fixed-dose combination in persons with a blood pressure of 140/90 mm Hg and higher or with a blood pressure more than 20/10 mm Hg above their blood pressure target [11, 22]. White coat hypertension must be excluded before using antihypertensive drugs in persons with hypertension at low risk for atherosclerotic cardiovascular disease. [11]

Secondary hypertension should be suspected if there is new onset or uncontrolled hypertension in

adults [11, 23]. Screen for secondary hypertension if there is drug-resistant /induced hypertension, abrupt onset of hypertension, onset of hypertension in a person younger than 30 years, exacerbation of previously controlled hypertension, disproportionate target organ damage for the degree of hypertension, accelerated/malignant hypertension, onset of diastolic hypertension in older persons, or unprovoked or excessive hypokalemia [11, 23]. Common causes of secondary hypertension include renal parenchymal disease, renovascular disease, primary aldosteronism, obstructive sleep apnea, and drug-or alcohol-induced hypertension [11]. Uncommon causes of secondary hypertension include pheochromocytoma/paraganglioma, Cushing's syndrome, hypothyroidism, hyperthyroidism, aortic coarctation, primary hyperparathyroidism, congenital adrenal hyperplasia, mineralocorticoid excess syndromes, and acromegaly [11].

The new hypertension guidelines recommended that the blood pressure should be lowered to less than 130/80 mm Hg in persons with ischemic heart disease [9–11, 19, 24] in persons with heart failure with a decreased left ventricular ejection fraction [11, 25], in persons with heart failure with a preserved left ventricular ejection fraction [11, 25], in persons with chronic kidney disease [11, 26], in persons after renal transplantation [11], in persons with lacunar stroke [11, 27], in persons with peripheral arterial disease [11, 18], in persons with diabetes mellitus [11, 28–31], in noninstitutionalized ambulatory community-dwelling persons older than 65 years of age. [9–11], and for secondary stroke prevention [11, 32].

ANTIHYPERTENSIVE DRUG TREATMENT RECOMMENDED

The new hypertension guidelines recommended for white and other non-black persons younger than 60 years of age with primary hypertension, the first antihypertensive drug should be an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker, the second drug a thiazide diuretic (preferably chlorthalidone) or a calcium channel blocker, and if a third antihypertensive drug is needed, an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker plus a thiazide diuretic plus a calcium channel blocker should be given [11]. For white and other non-black persons aged 60 years of age and older with primary hypertension, the first antihypertensive drug should be a thiazide diuretic (preferably chlorthalidone) or a calcium channel blocker, and if a third antihypertensive drug is required, a thiazide diuretic plus a calcium channel blocker plus an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker should be given [11]. For African-Americans with primary hypertension, the first antihypertensive drug should be a thiazide diuretic (preferably chlorthalidone) or a calcium channel blocker, and if a third antihypertensive drug is needed, a thiazide diuretic plus a calcium channel blocker plus an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker should be administered [11].

Persons with stable ischemic heart disease and hypertension should be treated with a beta blocker plus an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker, and if a third antihypertensive drug is needed, a beta blocker plus an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker plus a thiazide diuretic or a calcium channel blocker should be administered. [8, 11, 33–44]. If a fourth antihypertensive drug is needed to adequately control hypertension, a mineralocorticoid receptor antagonist should be added [11]. In persons with stable ischemic heart disease who have angina pectoris despite beta blocker therapy and persistent uncontrolled hypertension, a dihydropyridine calcium channel blocker should be added [8, [11, 33, 45]. Beta blockers which should be administered in treating ischemic heart disease with hypertension include carvedilol, metoprolol tartrate, metoprolol succinate, bisoprolol, nadolol, propranolol, and timolol 11]. Atenolol should not be given [8, 11, 35, 46, [47]. Nondihydropyridine calcium channel blockers such as verapamil and diltiazem are contraindicated if there is left ventricular systolic dysfunction. [11] If there is left ventricular systolic dysfunction, the beta blockers that should be administered are carvedilol, metoprolol succinate, or bisoprolol [8, 11, 34].

If hypertension persists after treatment with a beta blocker plus an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker in patients with an acute coronary syndrome, a long-acting dihydropyridine calcium channel blocker should be added to the therapeutic regimen [8, 11]. Aldosterone antagonists should be administered to patients treated with beta blockers plus angiotensin-converting enzyme inhibitors or angiotensin receptor blockers after myocardial infarction who have left ventricular systolic dysfunction and either heart failure or diabetes mellitus if their serum potassium is less than 5.0 meq/L and if their serum creatinine is ⩽2.5 mg/dL in men and ⩽ 2.0 mg/dL in women [8, 11, 48, 9].

Patients with hypertension who have heart failure with a decreased left ventricular ejection fraction should be treated with a beta blocker (carvedilol, metoprolol succinate, or bisoprolol) plus an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker or preferably an angiotensin receptor –neprolysin inhibitor plus a diuretic and if indicated with a mineralocorticoid receptor antagonist [11, 25, 35, 48, 49]. Nondihydropyridine calcium channel blockers are contraindicated in patients with heart failure and a decreased left ventricular ejection fraction. [11, 25, 50, 51].

Patients with hypertension and heart failure with a preserved left ventricular ejection fraction should have their volume overload treated with diuretics, their other comorbidities treated, and their hypertension treated with a beta blocker plus an angiotensin converting enzyme inhibitor or angiotensin blocker plus a mineralocorticoid receptor antagonist. [11, 25, 52, 53].

Patients with hypertension and chronic kidney disease stage 3 or higher or stage 1 or 2 chronic kidney disease with albuminuria ⩾300 mg per day should be treated with an angiotensin-converting enzyme inhibitor to slow progression of chronic kidney disease [11, 26, 54–56]. If an angiotensin-converting enzyme inhibitor is not tolerated, these patients should be treated with an angiotensin receptor blocker [11]. Patients with stage 1 or 2 chronic kidney disease who do not have albuminuria may be treated with usual first-line antihypertensive drugs [11]. If 3 antihypertensive drugs are necessary, these patients should be treated with an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker plus a thiazide diuretic plus a calcium channel blocker. After kidney transplantation, treat hypertension with a calcium channel blocker to improve glomerular filtration rate and kidney survival [11, 57].

Patients with hypertension and a prior stroke or transient ischemic attack should receive treatment with a thiazide diuretic or angiotensin-converting enzyme or angiotensin receptor blocker [11, 58–60]. If a third antihypertensive drug is needed, these patients should be treated with a thiazide diuretic plus an angiotensin-converting enzyme or angiotensin receptor blocker plus a calcium channel blocker.

Patients with hypertension and peripheral arterial disease should be treated with an angiotensin-converting enzyme or angiotensin receptor blocker or a calcium channel blocker or thiazide diuretic or beta blocker [11, 61]. There is no evidence that any one class of antihpertensive drugs is superior to treat hypertension in patients with peripheral arterial disease [11, 61]. Thiazide diuretics, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and calcium channel blockers are effective antihypertensive drugs In patients with hypertension and diabetes mellitus and may be used as initial therapy. [11, 62–64] Angiotensin-converting enzymes or angiotensin receptor blockers should be used for treating diabetics with hypertension and persistent albuminuria. [11, 65, 66]. Chlorthalidone was better than lisinopril, amlodipine, and doxazosin in reducing cardiovascular disease and renal outcomes in nondiabetic s with hypertension and the metabolic syndrome [11, 67].

Beta blockers are the preferred antihypertensive drugs in patients with hypertension and thoracic aortic aneurysm [11, 68]. Beta blockers also improve survival in adults with type A and with type B acute and chronic thoracic aortic dissection [11, 69, 70]. If thoracic aorta dissection develops, beta blockers are the initial drug of choice for reducing blood pressure, ventricular rate, dP/dt, and stress on the aorta [68, 71, 72]. Systolic blood pressure should be lowered to 100 to 120 mm Hg and the ventricular rate decreased to less than 60 beats/minute by intravenous propranolol, metoprolol, labetalol, or esmolol [68, 72].

Pregnant women with hypertension should not receive treatment with angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, direct renin inhibitors, or atenolol because these drugs are fetotoxic [11, 73–75]. Pregnant women with hypertension should be treated with methyldopa, nifedipine, and/or labetalol [11, 76, 77].

Resistant hypertension is diagnosed if the blood pressure is not controlled despite adequate doses of 3 first-line classes of antihypertensive drugs including a thiazide diuretic or if adequate blood pressure control needs 4 or more antihypertensive drugs from different classes [11, 78]. Therapy of resistant hypertension includes improving compliance with use of medication, detection and treatment of secondary hypertension, use of lifestyle measures, and treatment of obesity and other comorbidities [11, 16]. If a fourth antihypertensive drug is needed to control blood pressure in persons treated with adequate doses of antihypertensive drugs from different classes including a thiazide diuretic, a mineralocorticoid receptor antagonist should be added to the therapeutic regimen [11, 79].

Hypertensive emergencies are diagnosed if the systolic blood pressure is higher than 180 mm Hg or if

the diastolic blood pressure is higher than 120 mm Hg with the presence of acute target organ damage [11, 80]. Patients with a hypertensive emergency should be admitted to an intensive care unit for continuous monitoring of blood pressure and target organ damage and for intravenous administration of appropriate antihypertensive drugs. The drugs of choice for treating hypertensive emergencies caused by different disorders are extensively discussed elsewhere [11, 80].

In patients with hypertension, blood pressure lowering is reasonable to prevent cognitive decline and dementia [11, 81, 82]. We are awaiting the results from the Systolic Blood Pressure Intervention Trial (SPRINT) which is adequately powered to test whether intensive blood pressure control reduces dementia [11].

Patients with hypertension on beta blockers undergoing major surgery should continue treatment with beta blockers [11]. Beta blockers should not be started on the day of surgery in beta-blocker naive patients [11]. Abrupt preoperative discontinuation of beta blockers or clonidine is potentially harmful [11, 83, 84]. Patients undergoing major elective surgery should have their blood pressure controlled with a target blood pressure goal of less than 130/80 mm Hg [11]. Patients undergoing major elective surgery with a systolic blood pressure of ≥180 mm Hg or a diastolic blood pressure of ≥110 mm Hg should have their surgery deferred [11, 85]. Management of hypertension in patients undergoing surgery is discussed elsewhere. [86].

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