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Review Article

Overview of Hypertension

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Abstract

Hypertension is a main risk factor for stroke, heart failure, coronary and systemic atherosclerosis, and chronic kidney diseases. The prevalence of hypertension lower in high-income countries compared to in low- and middle-income countries. This article describes recent changes for the classifications, evaluation and treatment of hypertension in adults

Introduction

Hypertension is a major risk factor for stroke, heart failure, coronary and systemic atherosclerosis, and chronic kidney diseases [1]. Hypertension is responsible for 13% of all deaths, 62% of stroke, and 49% myocardial infarction [2] According to the 2017 American College of Cardiology-American Heart Association (ACC-AHA) Guideline, Hypertension is defined as systolic blood pressure of ≥130 mm Hg or diastolic blood pressure of ≥ 80 mm Hg (hereafter referred to as ≥130/80 mm Hg). The 2017 ACC/AHA guideline for classification of blood pressure is shown in Table 1 [1,3].

Table 1: *The classification of hypertension*

Category	Systolic (mmHg)	Diastolic (mmHg)
Normal	<120	<80
Elevated	120-129	<80
Hypertension: stage 1	130-139 mm	89-89 mm Hg.
Hypertension stage 2	≥140	≥ 90 mm Hg

The prevalence of hypertension varies in different parts of the world. In 2000, the global prevalence hypertension was 26.4% (26.6% of males and 26.1% of females). The total number of adults with hypertension in 2000 was 972 million; 333 million in developed countries and 639 million developing countries [4]. However, a Systematic Analysis of Population-Based Studies From 90 Countries in 2010 has shown that 31.1% (1.39 billion) of the world's adults had hypertension; 28.5% in high-income countries and 31.5% in low- and middle-income countries [5].

Pathophysiology

Hypertension is classified as primary (essential) and secondary hypertension. Primary or essential hypertension accounts for 90-95% of adult patients, and the remaining 5-10% of cases are categorized as secondary hypertension [6]. The pathogenesis of essential hypertension is unknown [7]. Primary hypertension is considered as a multifactorial disease arising from the combined interactions action of many genetic, environmental, and behavioral factors [8].

Lifestyle-related factors are linked with an increased risk of hypertension. They include high sodium intake, weight gain, excessive alcohol intake and consumption of some medications or illicit drugs, whereas the secondary causes for hypertension are include renal, renovascular, endocrine and urologic [1]

Management

There are two methods for the treatment of hypertension including non-pharmacologic and pharmacologic approaches [9]. The treatment of hypertensive patients depends on the presence cardiovascular disease, diabetes mellitus chronic kidney disease.

According to the 2017 ACC-AHA guideline, the treatment of hypertension decision depends on calculation of 10- year predicted risk of cardiovascular disease estimations (http://tools.acc.org/ASCVD-Risk-Estimator-Plus/#!/calculate/estimate/). Lifestyle modification is recommended for all patients with estimated risk is less than 10% for a period of 3 to 6 months. Both lifestyle modification and anti-hypertensive drugs are recommended for patients with stage 2 hypertension or with a 10-year risk for cardiovascular disease of 10% or higher or with preexisting cardiovascular disease, diabetes mellitus chronic kidney disease. A blood pressure goal of less than 130/80 mm Hg is recommended for all hypertensive patients [10].

Non-Pharmacological Therapy

Lifestyle Changes

Recommended lifestyle changes for the management of hypertension include restriction of dietary salt, weight loss if the hypertensive patient is overweight or obese, regular aerobic exercise, moderation of alcohol intake, smoking cession, and a diet high in fruits, vegetables, and low-fat dairy products. It is believed that anti-hypertensive effect of lifestyle change can be equivalent to drug monotherapy [10]. Each of these approaches is likely to decrease systolic blood and diastolic blood pressure by 3-8 mm Hg and 1-4 mm Hg, respectively [11].

Pharmacological Therapy

Despite lifestyle changes, if blood pressure is still ≥140/90 mm Hg, pharmacologic interventions should be initiated. Anti-hypertensive drugs include angiotensin converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), diuretics, calcium channel blockers and beta-blockers.

Based on ESH/ESC hypertension guideline, grade 1 hypertensive patients with low/moderate cardiovascular risk can start the anti-hypertensive medications with monotherapy as initial treatment [12]. The first-line medication in the treatment of hypertensive patients can be selected from one of the four major drug classes (thiazides, calcium channel blockers, ACE inhibitors and ARBs) [1,13, 14].

Table 2: *First-line antihypertensive drugs*

Drug names and classes	Dose	Indications	Side Effects
Thiazide-type diuretics		First-line therapy or add-on as second or third agent	Hyponatremia, hypokalemia, orthostatic hypotension,
Chlorthalidone	12.5-25 mg once daily		
Hydrochlorothiazide	2.5-50 mg once daily		
Indapamide	1.25-2.5 mg once daily		

ACE inhibitors			
Benazepril	5-80 mg/day, in one or two doses	First-line therapy or add-on as second or third agent; CKD with albuminuria; congestive heart failure; after myocardial infarction	Combination with ARB or direct renin inhibitor; hyperkalemia; may cause serum creatinine elevation in patients with CKD (chronic kidney disease) or bilateral renal-artery stenosis; angioedema is infrequent but is 2 to 4 times as common among blacks as among whites; contraindicated in pregnancy.
Fosinopril	10-80 mg/day, in one or two doses		
Lisinopril	5-40 mg once daily		
Moexipril	7.5-30 mg/day, in one or two doses		
Perindopril	4-16 mg/day, in one or two doses		
Perindopril	10-80 mg/day, in one or two doses		
Ramipril	2.5-20 mg/day, in one or two doses		
Trandolapril	2-8 mg/day, in one or two doses		
ARBs			
Azilsartan	40-80 mg once daily	First-line therapy or add-on as second or third agent; CKD with albuminuria; congestive heart failure; after myocardial infarction; alternative for patients with chronic cough or ACE-inhibitor– associated or cough	Combination with ACE inhibitor or direct renin inhibitor; hyperkalemia; may cause serum creatinine elevation in patients with CKD bilateral renal-artery stenosis; contraindicated in pregnancy. Patients with history of angioedema with an ACE inhibitors can receive an ARB beginning 6 weeks after ACE inhibitors discontinued
Candesartan	8-32 mg/day, in one or two doses		
Eprosartan	600 mg/day, in one or two doses		
Irbesartan	150-300 mg once daily		
Losartan	25-100 mg/day, in one or two doses		
Olmesartan	20-40 mg once daily		
Telmisartan	20-80 mg once daily		
Valsartan	80-320 mg once daily		
Calcium-channel blockers			
Dihydropyridine type		First-line therapy or add-on as second or third agent; no effect on serum creatinine level; minimal effect on cardiac output	Edema of the legs and feet; may worsen proteinuria; may worsen left ventricular outflow tract obstruction associated with dose-related pedal edema, which is mote in women than men.
Amlodipine	2.5-10 mg once daily		
Felodipine	2.5-10 mg once daily		
Isradipine	5-10 mg/day, in two doses		
Nicardipine ER	5-20 mg once daily		

Nifedipine ER	30-120 mg/day, in one or two doses		
Nisoldipine ER	17-34 mg once daily		
Nisoldipine ER	20-60 mg once daily		
Nondihydropyridine type			
Diltiazem SR	180-360 mg/day, in two doses	Tachycardia, left ventricular outflow tract obstruction, hyperdynamic cardiac function migraine prophylaxis	Constipation; heart block if used in combination with, beta-blocker.
Diltiazem ER	120-480 mg once daily		
Verapamil SR	120-480 mg/day, in one or two doses		
Verapamil delayed-onset ER	100-480 mg once daily		

Monotherapy

Monotherapy is successfully decrease blood pressure in most patients with mild primary hypertension. However, monotherapy is not effective in reducing blood pressure than 20/10 mm Hg. In this group patients the combination of wo antihypertensive drugs is recommended [6].

Renin Angiotensin Aldosterone System (RAS) Blockers

RAS blockers have been reduced cardiovascular mortality and incidence of the incidence of end-organ damage [15]. ACE inhibitors and ARBs are the first-line drugs in the management of diabetic hypertensives hypertension [16].

Diuretics

Diuretics increase the excretion of renal sodium and water [17]. Diuretics have improved cardiovascular outcomes and reduce risk of stroke [18]. Thiazide and thiazide-like diuretics have been the gold standard treatment for primary hypertension [19]. According to the JNC-7, thiazide diuretics are first line drugs to treat hypertension, either alone or in combination with other classes of anti-hypertensive drugs [20].

Calcium Channel Blockers

Calcium channel blockers are most commonly used antihypertensive drugs. These group of antihypertensive drugs have potent antihypertensive effects. Calcium channel blockers had efficacy in decreasing cardiovascular morbidity and mortality among hypertensive patients [21].

Calcium channel blockers are generally categorized into two groups as dihydropyridine and non-dihydropyridine groups. as dihydropyridine and non-dihydropyridine groups. Non-dihydropyridine calcium channel blockers are more negatively chronotropic and inotropic compared to the dihydropyridine group. This group of calcium channel blockers are not recommended as first-line drugs in the treatment of hypertension. According to the NICE guidelines (National Institute for Health and Care Excellence), calcium channel blockers can be used as first-line therapy among hypertensive patients older than 55 years [10].

Beta Blockers

The 2013 ESH/ESC guidelines recommended that the use of beta blockers as one of the first-line medication in the treatment of hypertension [12]. However, the 2014 NICE hypertension guidelines recommended that beta-blockers should not use as first choice anti-hypertensive drugs. Beta-blockers can be used as additional therapy to decrease blood pressure and this group of antihypertensive medications are useful in preventing recurrent coronary artery disease [22].

Alpha Blockers

Alpha blockers are associated with an increase the risk of cardiovascular events Therefore, alpha blockers are not recommended as the first-line drug for hypertension [19]. These drugs include: Prazosin, Terazosin and Doxazosin are used only older hypertensive patients with benign prostate hypertrophy [23].

Combination Therapy

A combination therapy is recommended in those patients with a systolic blood pressure >20 mmHg and/or a diastolic blood pressure >10 mmHg above the goals and hypertensive patients at high cardiovascular risk [24]. There are different combinations of antihypertensive drugs. Commonly used combinations of antihypertensive drugs are ACE inhibitors or ARBs and calcium channel blockers or diuretics which have fully additive blood pressure reduction [25]. However, combinations calcium channel blocker and diuretics or beta-blockers and RAS blockers do not have additive blood pressure reduction effects [26].

Conclusion

According to the 2017 ACC-AHA Guideline, hypertension is defined as systolic blood pressure systolic blood pressure of ≥130 mm Hg or diastolic blood pressure of ≥80 mm Hg. The treatment of hypertension is included pharmacologic and non-pharmacologic approaches. Anti-hypertensive drugs include angiotensin converting enzyme ACE inhibitors, ARBs, diuretics, calcium channel blockers and beta-blockers. A combination therapy is recommended in those patients with a systolic blood pressure >20 mmHg and/or a diastolic blood pressure >10 mmHg above the goals and hypertensive patients at high cardiovascular risk.

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Conflict of Interest

None

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