

Hypertension

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Factors Influencing Blood Pressure

$$\text{Blood Pressure} = \text{Cardiac Output} \times \text{Systemic Vascular Resistance}$$

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Factors Influencing BP

- HR
- SNS/PNS
- Vasoconstriction/vasodilation
- Fluid volume
 - Renin-angiotensin
 - Aldosterone
 - ADH

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Hypertension Definition

- **Hypertension is sustained elevation of BP**
 - **Systolic blood pressure ≥ 140 mm Hg**
 - **Diastolic blood pressure ≥ 90 mm Hg**

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Blood Pressure Classification

BP Classification	SBP mmHg	DBP mmHg
Normal	< 120 and	< 80
Pre-hypertension*	120-139 or	80-89
Stage 1 Hypertension	140-159 or	90-99
Stage 2 Hypertension	≥ 160 or	≥ 100
*newly recognized, requiring lifestyle modifications		5

Hypertension

- **For persons over age 50, SBP is more important than DBP as a CVD risk factor**
- **Starting at 115/75 mmHg, CVD risk doubles with each increment of 20/10 mmHg throughout the BP range**

Classification of Hypertension

- **Primary (Essential) Hypertension**
 - **Elevated BP with unknown cause**
 - **90% to 95% of all cases**
- **Secondary Hypertension**
 - **Elevated BP with a specific cause**
 - **5% to 10% in adults**

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Classification of Hypertension

- **Primary Hypertension**
 - **Contributing factors:**
 - **↑ SNS activity**
 - **Diabetes mellitus**
 - **↑ Sodium intake**
 - **Excessive alcohol intake**

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Classification of Hypertension

- **Secondary Hypertension**
 - **Contributing factors:**
 - **Coarctation of aorta**
 - **Renal disease**
 - **Endocrine disorders**
 - **Neurologic disorders**
 - **Rx: Treat underlying cause**

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Risk Factors for Primary Hypertension

- **Age (> 55 for men; > 65 for women)**
- **Alcohol**
- **Cigarette smoking**
- **Diabetes mellitus**
- **Elevated serum lipids**
- **Excess dietary sodium**
- **Gender**

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Risk Factors for Primary Hypertension

- **Family history**
- **Obesity (BMI ≥ 30)**
- **Ethnicity (African Americans)**
- **Sedentary lifestyle**
- **Socioeconomic status**
- **Stress**

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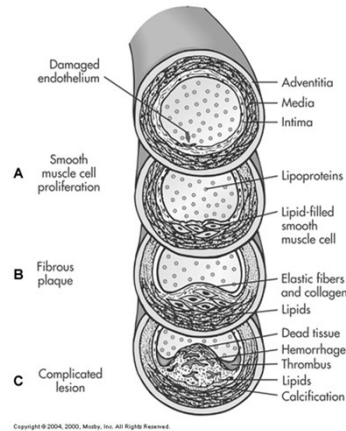
Hypertension Clinical Manifestations

- **Frequently asymptomatic until severe and target organ disease has occurred**
 - **Fatigue, reduced activity tolerance**
 - **Dizziness**
 - **Palpitations, angina**
 - **Dyspnea**

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Hypertension: Complications

- Complications are primarily related to development of atherosclerosis (“hardening of arteries”), or fatty deposits that harden with age



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Hypertension Complications

The common complications are target organ diseases occurring in the

- **Heart**
- **Brain**
- **Kidney**
- **Eyes**

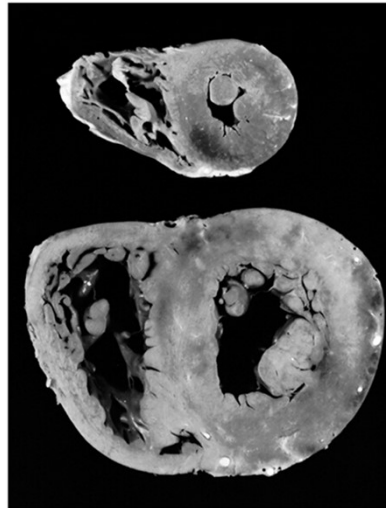
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Hypertension Complications

- **Hypertensive Heart Disease**
 - **Coronary artery disease**
 - **Left ventricular hypertrophy**
 - **Heart failure**

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Left Ventricular Hypertrophy



From Kissane JM: *Anderson's pathology*, ed 9, St. Louis, 1990, Mosby.
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Hypertension Complications

- **Cerebrovascular Disease**
 - **Stroke**
- **Peripheral Vascular Disease**
- **Nephrosclerosis**
- **Retinal Damage**

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Hypertension Diagnosis

- **Diagnosis requires several elevated readings over several weeks (unless $\geq$ 180/110)**
- **BP measurement in both arms**
 - **Use arm with higher reading for subsequent measurements**

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Hypertension Diagnosis

- Ambulatory BP Monitoring
 - For “white coat” phenomenon, hypotensive or hypertensive episodes, apparent drug resistance

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Treatment Goals

- **Goal is to reduce overall cardiovascular risk factors and control BP by the least intrusive means possible**
 - **BP < 140/90**
 - **In patients with diabetes or renal disease, goal is < 130/80**

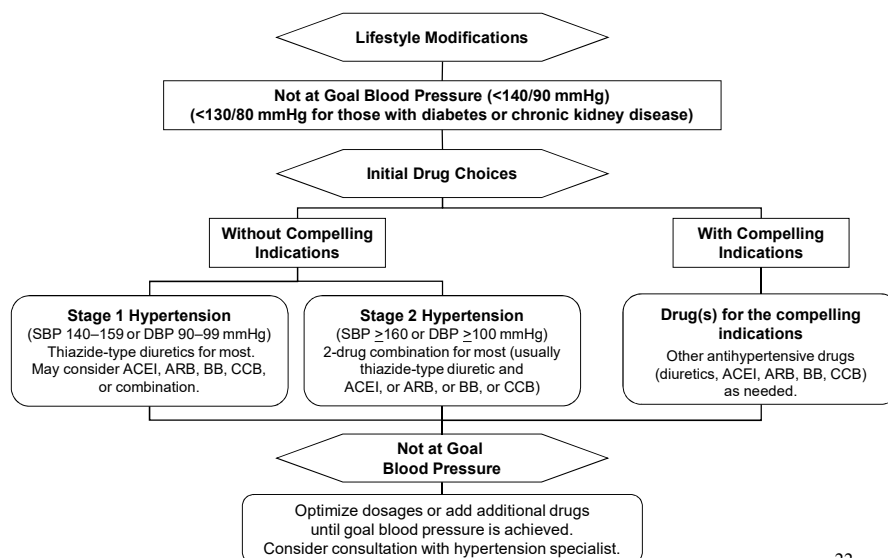
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Benefits of Lowering BP

Average Percent Reduction	
Stroke incidence	35–40%
Myocardial infarction	20–25%
Heart failure	50%

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Algorithm for Treatment of Hypertension



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Hypertension Collaborative Care

- **Lifestyle Modifications**
 - **Weight reduction**
 - **Dietary changes (DASH diet)**
 - **Limitation of alcohol intake (≤ 2 drinks/day for men;
 ≤ 1 /day for women)**
 - **Regular physical activity**
 - **Avoidance of tobacco use**
 - **Stress management**

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Hypertension Collaborative Care

- **Nutritional Therapy: DASH Diet =
Dietary Approaches to Stop HTN**
 - **Sodium restriction**
 - **Rich in vegetables, fruit, and nonfat
dairy products**
 - **Calorie restriction if overweight**

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Hypertension Collaborative Care

- **Drug Therapy**
 - **Reduce SVR**
 - **Decrease volume of circulating blood**

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Hypertension Collaborative Care

- **Drug Therapy**
 - **Diuretics**
 - **Adrenergic inhibitors (α 2- Agonists)**
 - **α 1 - Adrenergic blockers**
 - **β - Adrenergic blockers**
 - **ACE Inhibitors**
 - **ARBs (Angiotensin receptor blockers)**
 - **Calcium channel blockers**

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Hypertension: Drug Therapy

- Adrenergic Inhibitors:
 - Reduce sympathetic effects that cause HTN by:
 - Reducing sympathetic outflow
 - Blocking effects of sympathetic activity on vessels
 - Side effects
 - Hypotension
 - Varied, depending on specific drug

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Hypertension: Drug Therapy α_2 -adrenoceptor agonists

Drugs such as Clonidine, Methyldopa, Guanabenz, Guanfacine, and Lofexidine have their primary site of antihypertensive action in the central nervous system (CNS) to activate alpha 2-adrenergic receptors and lower arterial pressure.

- Inhibit SNS outflow
 - Side effects:
 - sedation, dry mouth and nasal mucosa (because of increased vagal activity), bradycardia, orthostatic hypotension.
 - Impotence, decreased libido

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Hypertension: Drug Therapy

α_1 -adrenoceptor antagonists

Drugs such as Prazosin, Terazosin, Doxazosin, Silodosin, Alfuzosin, and Tamsulosin. Alpha-1 blockers inhibit the activation of post-synaptic alpha-1 receptors by norepinephrine, thus opposing blood vessel contraction. Alpha-1 blockers do not affect renin release or cardio output.

- Side effects:
 - First-dose effect (a much stronger effect on blood pressure at first than later doses)
 - Dizziness.
 - Priapism, an erection that lasts four or more hours.
 - Impotence, decreased libido

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Hypertension: Drug Therapy

- **Thiazide-type Diuretics:**
 - Chlorothiazide(Diuril)
 - Chlorthalidone.
 - Hydrochlorothiazide (Microzide)
 - Indapamide.
 - Metolazone.
- **Furosemide (Henle loop Diuretic)**
 - Inhibit NaCl reabsorption
 - Side effects:
 - Electrolyte imbalances: $\downarrow$ Na, $\downarrow$ Cl, $\downarrow$ K⁺⁺ (advise K rich foods)
 - Fluid volume depletion (monitor for orthostatic hypotension)
 - Impotence, decreased libido

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Hypertension: Drug Therapy

- β – adrenergic blockers (suffix “olol”)
Propranolol, Nebivolol, Atenolol, Oxprenolol, Metoprolol, Timolol, Pindolol, Nadolol.
 - Block β – adrenergic receptors
 - $\downarrow$ HR, $\downarrow$ inotropy, reduces sympathetic vasoconstriction)
 - Side effects
 - Bradycardia, hypotension, heart failure, impotence

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Hypertension: Drug Therapy

- ACE Inhibitors (suffix “pril”)
 - Captopril (Capoten), Enalapril (Vasotec), Benazepril (Lotensin, Lotensin Hct), Fosinopril (Monopril), Lisinopril (Prinivil, Zestril), Moexipril (Univasc), Perindopril (Aceon), Quinapril (Accupril).
 - Prevents conversion of angiotensin I to angiotensin II, thereby preventing the vasoconstriction associated with A II.
 - Side effects
 - Hypotension, cough, angioedema, metallic or salty taste, Chest pain, hyperuricemia, and Increased BUN and creatinine levels.

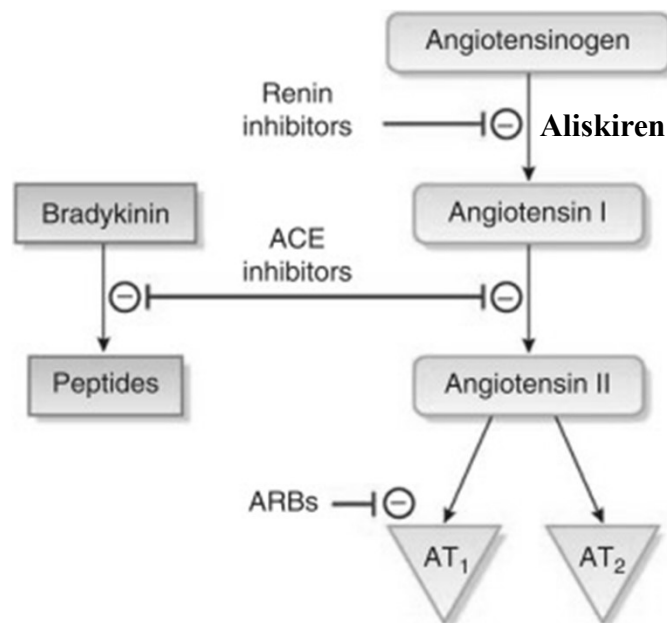
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Hypertension: Drug Therapy

- Angiotensin II Receptor Blockers (suffix “sartan”)
 - **Examples of ARBs include** losartan (Cozaar), valsartan (Diovan), irbesartan (Avapro), candesartan (Atacand), eprosartan mesylate (Teveten), and telmisartan (Micardis).
 - **ARBs** also affect angiotensin but they prevent angiotensin II on blood vessels receptors that blood vessels remain relaxed and blood pressure decreases.
 - Side effects
 - Hypotension, cough, hyperkalemia, dizziness, headache, drowsiness, metallic or salty taste, fatigue and upper respiratory tract infection.

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ACEIs vs. ARBs



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Hypertension: Drug Therapy

- **Calcium Channel Blockers**

Amlodipine (Norvasc), Diltiazem (Cardizem, Tiazac, others)
Felodipine, Isradipine, Nicardipine, Nifedipine (Adalat CC, Procardia), Nisoldipine (Sular), Verapamil (Calan, Verelan).

- Block movement of calcium into cells, causing vasodilation
- Side effects
 - Bradycardia, heart block, Constipation

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Hypertension Collaborative Care

- **Drug Therapy and Patient Teaching**
 - **Identify, report, and minimize side effects**
 - **Orthostatic hypotension**
 - **Sexual dysfunction**
 - **Dry mouth**
 - **Frequent urination**

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Hypertensive Crisis Clinical Manifestations

- **Hypertensive encephalopathy (H/A, N & V, seizures, confusion, coma)**
- **Renal insufficiency**
- **Heart failure**
- **Pulmonary edema**

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Hypertensive Crisis Nursing and Collaborative Management

Hospitalization

- **IV drug therapy:** Hydralazine, Labetalol, Nicardipine, Sodium Nitroprusside, Phentolamine, Esmolol, ect...
- **Monitor cardiac and renal function**
- **Neurologic checks**
- **Determine cause**
- **Education to avoid future crises**

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Supporting Materials

- **Website www.nhlbi.nih.gov**
- **For patients and the general public**
 - **Facts About the DASH Eating Plan**
 - **Your Guide to Lowering Blood Pressure**
- **For health professionals**
 - **Reference Card**

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Thanks for your attention

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