

Etiology of Hypertension

- A specific cause of hypertension established in only 10–15% of patients.
- Patients in whom no specific cause of hypertension are said to have **essential or primary hypertension**.
- Patients with a specific etiology are said to have **secondary hypertension**.
- Genetic factors, psychological stress, and environmental and dietary factors as contributing to the development of hypertension. The heritability of essential hypertension is estimated to be about 30%.

Classification of hypertension on the basis of blood pressure

**JNC 7;
2003**

Systolic/Diastolic Pressure (mm Hg)	Category
< 120/80	Normal
120–135/80–89	Prehypertension
≥ 140/90	Hypertension
140–159/90–99	Stage 1
≥ 160/100	Stage 2

From the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. JAMA 2003;289:2560.

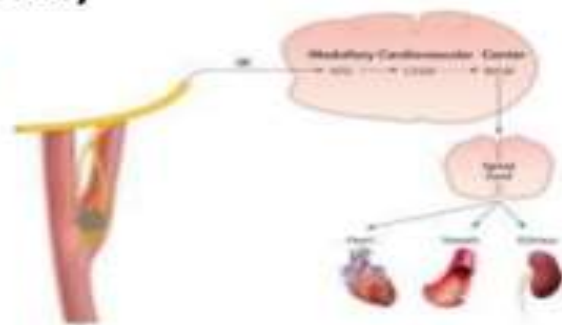
Normal Regulation of Blood Pressure

According to the hydraulic equation, arterial blood pressure (BP) is directly proportionate to the product of the blood flow (cardiac output, CO) and the resistance to passage of blood through precapillary arterioles (peripheral vascular resistance, PVR)

- **$BP = CO \times PVR$**

Blood pressure is maintained by

- Moment-to-moment regulation of cardiac output and peripheral vascular resistance exerted at three anatomic sites **arterioles**, **postcapillary venules** (capacitance vessels), and **heart**.
- **Kidney**
- **Baroreflexes** mediated by autonomic nerves (combination with humoral mechanisms, including the renin-angiotensin-aldosterone system)
- Local release of **vasoactive substances**



Antihypertensive agents

- **Diuretics**

- Thiazides: Hydrochlorothiazide, Chlorthalidone, Indapamide
- High ceiling: Furosemide, Torsemide, ethacrynic acid.
- K⁺ Sparing: Spironolactone, Amiloride

- **ACE inhibitors**

- Captopril, Enalapril, Lisinopril, Perindopril, Ramipril, Fosinopril, etc.

- **Angiotensin (AT₁ receptor) blockers:** Losartan, Candesartan, Irbesartan, Valsartan, Telmisartan

- **Direct renin inhibitor:** Aliskiren

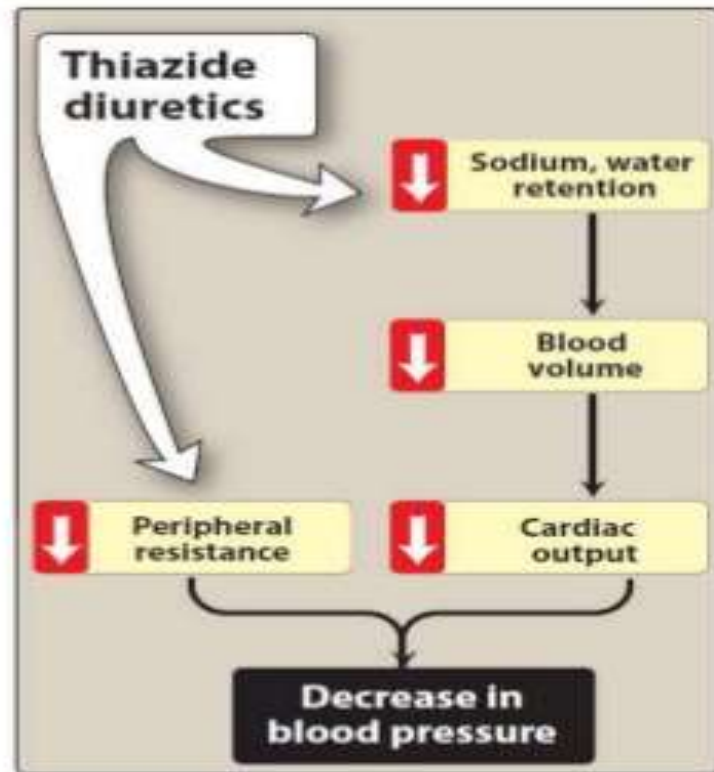
- **β Adrenergic blockers:** Propranolol, Metoprolol, Atenolol, etc.

Antihypertensive agents

- **Calcium channel blockers**
 - Verapamil, Diltiazem, Nifedipine, Felodipine, Amlodipine, Nitrendipine, Lacidipine, etc.
- **β + α Adrenergic blockers:** Labetalol, Carvedilol
- **α Adrenergic blockers:** Prazosin, Terazosin, Doxazosin, Phentolamine, Phenoxybenzamine
- **Central sympatholytics:** Clonidine, Methyldopa
- **Vasodilators**
 - Arteriolar: Hydralazine, Minoxidil, Diazoxide
 - Arteriolar + venous: Sodium nitroprusside
- **Others:** Adrenergic neurone blockers (Reserpine, Guanethidine, etc.), Ganglion blockers (Pentolinium, etc.)

Diuretics

- **Thiazide diuretics:** Thiazide diuretics, such as hydrochlorothiazide and chlorthalidone, lower blood pressure initially by increasing sodium and water excretion. Thiazide diuretics can induce hypokalemia, hyperuricemia and, to a lesser extent, hyperglycemia in some patients.



Diuretics

- *Loop diuretics:*
- Inhibitors of epithelial sodium transport at the late distal and collecting ducts (**furosemide**, and **ethacrynic acid**) or antagonizing aldosterone receptor (**spironolactone**, and **eplerenone**) and **reduce potassium loss in the urine**.
- Aldosterone antagonists have the additional benefit of diminishing the cardiac remodeling that occurs in heart failure.

Diuretics

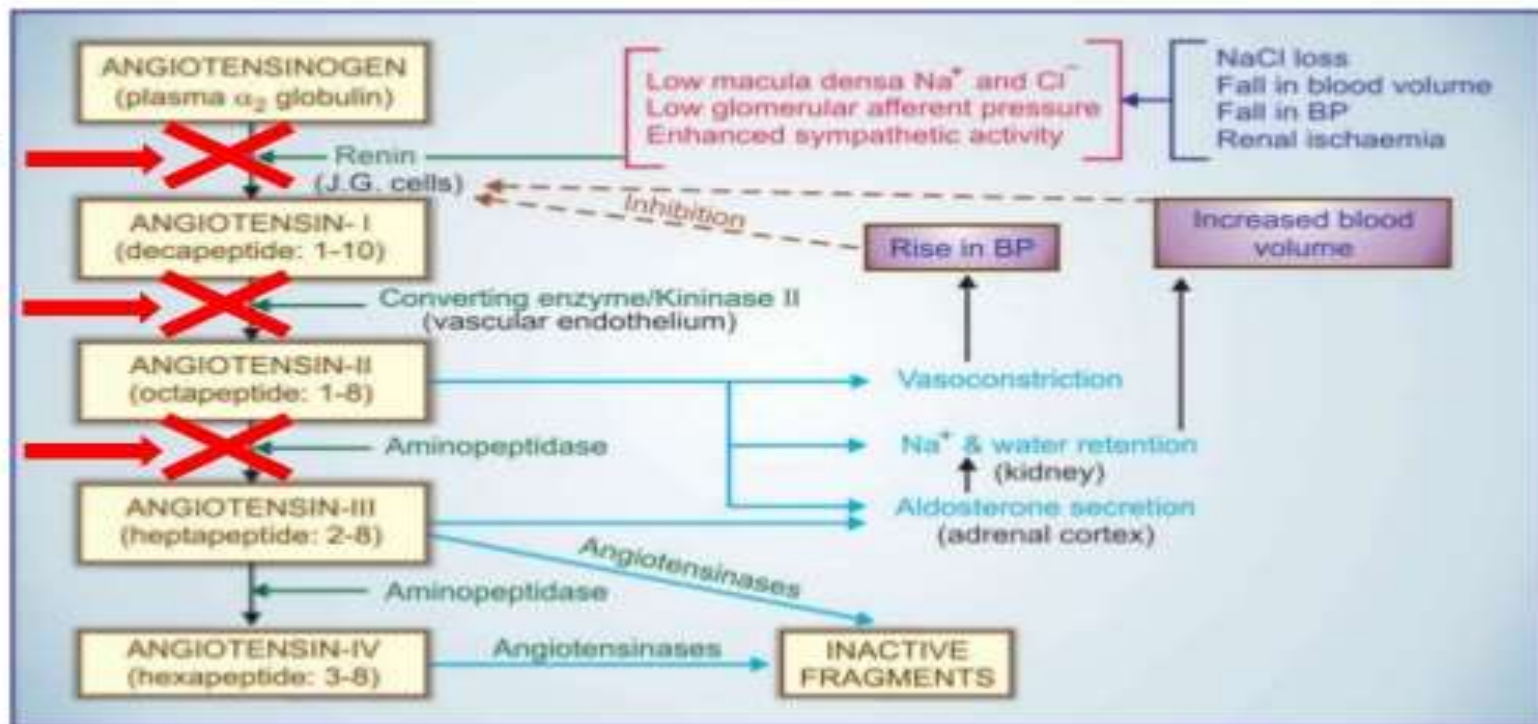
- *K⁺ Sparing:*
- potassium-sparing diuretics (**spironolactone**, and **eplerenone**) are competitive antagonists that either compete with aldosterone, or directly block epithelial sodium channel (**amiloride**).

ACE inhibitors

Renin Inhibitors

ACE Inhibitors

Angiotensin blockers





ACE inhibitors

- The ACE inhibitors, are recommended as first-line treatment of hypertension in patients with a variety of compelling indications, including high coronary disease risk or history of diabetes, stroke, heart failure, myocardial infarction, or chronic kidney disease.