Anti-Hypertensive Agents

Hypertension

- Hypertension, commonly known as high blood pressure, is a chronic medical condition where the blood pressure in the arteries is persistently elevated.
- It increases the risk of heart disease, stroke, and other serious health issues.

Blood Pressure Classification

Category	Systolic (mmHg)	Diastolic (mmHg)
Normal	< 120	< 80
Pre-Hypertension	120 – 139	80 – 89
Stage 1 Hypertension	140 – 159	90 – 99
Stage 2 Hypertension	> 160	> 100

Causes of Hypertension

1. **Lifestyle Factors:**
   - Chronic stress
   - Smoking
2. **Biological Factors:**
   - Advancing age
   - Family history/genetics
   - Increased sympathetic nervous system activity
3. **Medical Conditions:**
   - Chronic kidney disease
   - Adrenal gland disorders
   - Thyroid disorders
   - Chronic arterial disease

Effects of Hypertension

1. **Cardiovascular Complications:**
   - Heart attack
   - Stroke
   - Heart failure
2. **Organ Damage:**

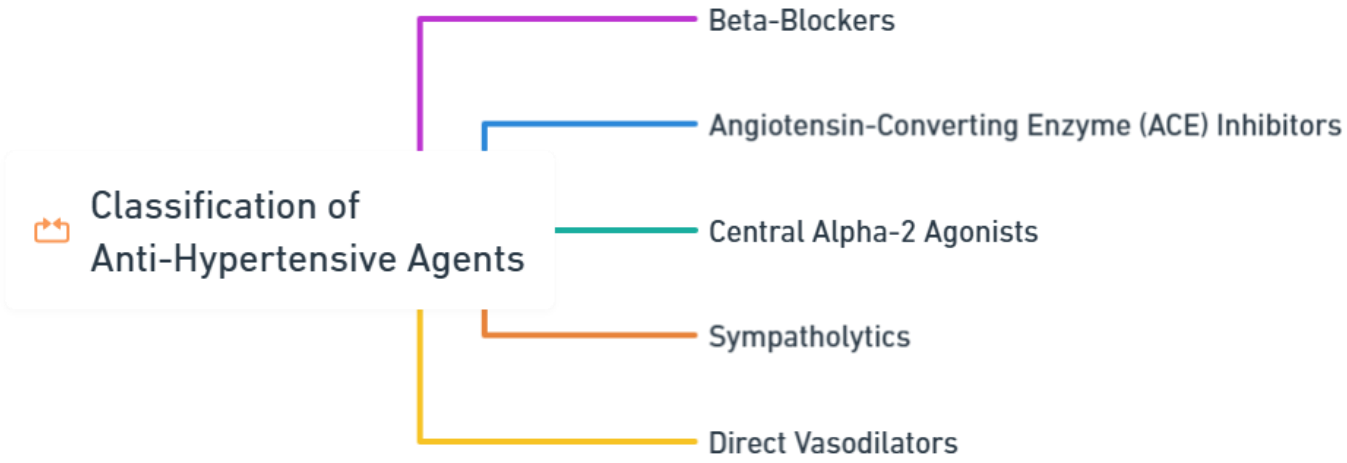
- Retinopathy (eye problems)
- Kidney damage

3. **Metabolic and Neurological Issues:**
   - Metabolic syndrome
   - Brain stroke
4. **Other Complications:**
   - Sexual dysfunction

Anti-Hypertensive Agents

- Anti-hypertensive agents are drugs used to manage high blood pressure (hypertension).
- They work through various mechanisms to lower blood pressure and reduce the risk of complications like heart attack, stroke, and kidney failure.

Classification of Anti-Hypertensive Agents



1. **Beta-Blockers**
   - **Mechanism:** Reduce heart rate and cardiac output by blocking β-adrenergic receptors.
     - Timolol
2. **Angiotensin-Converting Enzyme (ACE) Inhibitors**
   - **Mechanism:** Inhibit the conversion of angiotensin I to angiotensin II, leading to vasodilation and reduced aldosterone secretion.
     - Captopril
     - Lisinopril
     - Enalapril
     - Benazepril Hydrochloride
     - Quinapril Hydrochloride

3. Central Alpha-2 Agonists

- **Mechanism:** Activate alpha-2 adrenergic receptors in the brain, decreasing sympathetic outflow and reducing blood pressure.
  - Clonidine Hydrochloride
  - Methyldopate Hydrochloride

4. Sympatholytics

- **Mechanism:** Inhibit the sympathetic nervous system through various pathways, leading to decreased vascular resistance and heart rate.
  - Guanethidine Monosulphate
  - Guanabenz Acetate
  - Reserpine

5. Direct Vasodilators

- **Mechanism:** Directly relax vascular smooth muscles, causing vasodilation and reducing peripheral resistance.
  - Hydralazine Hydrochloride
  - Minoxidil
  - Sodium Nitroprusside
  - Diazoxide

Summary Table

Class	Mechanism	Medications
Beta-Blockers	Block β-adrenergic receptors; reduce heart rate and output	Timolol
ACE Inhibitors	Inhibit conversion of angiotensin I to II; vasodilation	Captopril, Lisinopril, Enalapril, Benazepril HCl, Quinapril HCl
Central Alpha-2 Agonists	Activate alpha-2 receptors; decrease sympathetic outflow	Clonidine HCl, Methyldopate HCl*
Sympatholytics	Inhibit sympathetic nervous system	Guanethidine Monosulphate, Guanabenz Acetate, Reserpine
Direct Vasodilators	Directly relax vascular smooth muscles	Hydralazine HCl, Minoxidil, Sodium Nitroprusside, Diazoxide

Brand Names Of Important Marketed Products

Used for **high blood pressure** management.

Class	Drug	Brand Name(s)	Use

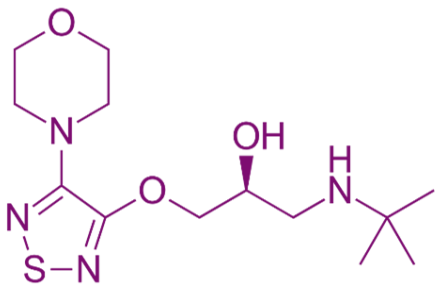
ACE Inhibitors	Enalapril	**Envas, Vasotec**	Hypertension, CHF
ARBs	Losartan	**Losar, Cozaar**	Hypertension, nephropathy
Beta-Blockers	Metoprolol	**Betaloc, Metolar**	HTN, angina, heart failure
Calcium Channel Blockers	Amlodipine	**Amlong, Norvasc**	Hypertension, angina
Diuretics	Hydrochlorothiazide	**Aquazide, Esidrex**	Edema, HTN
Centrally Acting	Clonidine	**Arkamin, Catapres**	Resistant HTN

Various Beta-Blockers

1. Timolol

Structure

- Timolol is a non-selective beta-adrenergic receptor blocker featuring a diphenylmethanol structure with a secondary amine.
- Chemical Formula: $C_{15}H_{22}N_2O_3$



Mode of Action

- **Beta-Blockade:** Inhibits both β_1 and β_2 adrenergic receptors.
- **Cardiac Effects:** Reduces heart rate, myocardial contractility, and cardiac output.
- **Vascular Effects:** Decreases renin release from the kidneys, leading to vasodilation and reduced blood pressure.
- **Ocular Effects:** Reduces intraocular pressure by decreasing aqueous humor production (used in glaucoma).

Uses

- **Hypertension:** Lowers blood pressure by decreasing cardiac output and renin release.
- **Angina Pectoris:** Reduces myocardial oxygen demand by lowering heart rate and contractility.
- **Arrhythmias:** Manages supraventricular and ventricular arrhythmias by slowing AV node conduction.

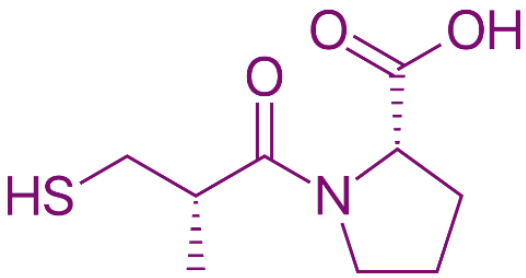
- **Glaucoma:** Topically applied to reduce intraocular pressure.
- **Migraine Prophylaxis:** Prevents migraine attacks by stabilizing vascular tone.

Various ACE Inhibitors

1. Captopril

Structure

- Captopril is the first synthetic ACE inhibitor, featuring a sulfhydryl (-SH) group attached to a proline moiety.
- Chemical Formula: $C_9H_{17}NO_3S$



Mode of Action

- **ACE Inhibition:** Blocks the angiotensin-converting enzyme (ACE), preventing the formation of angiotensin II.
- **Vasodilation:** Reduces vasoconstriction and aldosterone secretion, leading to decreased blood pressure.
- **Renal Effects:** Lowers glomerular filtration pressure, beneficial in diabetic nephropathy.

Uses

- **Hypertension:** Lowers systemic vascular resistance and blood pressure.
- **Heart Failure:** Reduces afterload and preload, improving cardiac output.
- **Post-Myocardial Infarction:** Prevents remodeling and reduces mortality.
- **Diabetic Nephropathy:** Slows progression of kidney damage in diabetic patients.
- **Left Ventricular Dysfunction:** Enhances cardiac function by reducing myocardial workload.

2. Lisinopril

Structure

- Lisinopril is a long-acting, non-proteinogenic amino acid derivative ACE inhibitor with a lysine moiety.

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