

Beta Blockers

Beta blockers are drugs that inhibit **beta-adrenergic receptors**

(β_1 , β_2 , β_3), thereby **reducing heart rate, contractility, blood pressure, and oxygen demand**.

Classification of Beta Blockers

◆ **Based on Receptor Selectivity:**

Type	Action	Examples
Non-selective β blockers	Block both β_1 and β_2 receptors	Propranolol, Timolol, Nadolol
Selective β_1 blockers (Cardioselective)	Prefer β_1 (heart) only	Atenolol, Metoprolol, Esmolol
β-blockers with α-blocking property	Block $\beta + \alpha_1$ receptors	Labetalol, Carvedilol
Partial agonists (ISA)	Weakly stimulate while blocking	Pindolol, Acebutolol
Ultra-short acting	IV, very short half-life	Esmolol

Mechanism of Action

- **β_1 blockade (heart):** $\downarrow$ HR, $\downarrow$ contractility, $\downarrow$ cardiac output $\rightarrow$ $\downarrow$ BP
- **β_2 blockade (lungs, vessels):** bronchoconstriction, vasoconstriction
- **Inhibit renin release** (β_1 effect on kidneys)
- **Reduce intraocular pressure** (via ciliary body in glaucoma)

Important Beta Blockers and Features

Drug	Selectivity	Use	Special Notes
Propranolol	Non-selective	Hypertension, anxiety, tremor	Crosses BBB (lipophilic)
Atenolol	β_1 -selective	HTN, post-MI	Hydrophilic (less CNS effect)
Metoprolol	β_1 -selective	CHF, HTN, post-MI	Commonly used in CHF
Esmolol	β_1 -selective	Emergency HTN, SVT	Ultra-short acting (IV use)
Timolol	Non-selective	Glaucoma	Topical use
Carvedilol	$\beta + \alpha_1$ blocker	CHF, HTN	Vasodilatory
Labetalol	$\beta + \alpha_1$ blocker	Hypertension in pregnancy	Safe in eclampsia
Pindolol	Partial agonist	HTN with bradycardia	Rarely used

Clinical Uses of Beta Blockers

Indication	Preferred Beta Blocker(s)
Hypertension	Atenolol, Metoprolol
Angina pectoris	Propranolol, Metoprolol
Myocardial infarction (MI)	Metoprolol, Atenolol
Congestive heart failure	Carvedilol, Metoprolol (long-acting)
Arrhythmias	Esmolol, Propranolol
Glaucoma	Timolol
Migraine prophylaxis	Propranolol
Hyperthyroidism	Propranolol
Anxiety	Propranolol
Hypertension in pregnancy	Labetalol

Adverse Effects

- Bradycardia
- Hypotension
- Fatigue, lethargy
- **Bronchospasm** (non-selective blockers)
- **Erectile dysfunction**
- **Masking of hypoglycemia symptoms**
- Cold extremities

Contraindications

- **Asthma, COPD** (especially non-selective)
- **Heart block**, severe bradycardia
- **Peripheral vascular disease**
- **Diabetics** (use cardioselective with caution)

Comparison: β_1 vs β_2 Blockade

Feature	β_1 Blockade (Heart)	β_2 Blockade (Lungs, Vessels)
↓ HR & contractility	✓ Yes	✗ No
↓ Renin secretion	✓ Yes	✗ No
Bronchoconstriction	✗ No	✓ Yes (important in asthma)
Vasoconstriction	✗ No	✓ Yes (cold extremities)
CNS effects (if lipophilic)	✓ Yes	✓ Yes

Key Points

- **DOC for HTN in pregnancy: Labetalol**
- **Used in CHF: Carvedilol, Metoprolol**
- **Used in glaucoma: Timolol**
- **Mask hypoglycemia:** Beta blockers (especially in diabetics)
- **Avoid in asthma:** Non-selective β -blockers
- **Sudden withdrawal:** May cause **rebound hypertension, angina, MI**

Mnemonic to Remember β_1 -Selective Blockers (A–M)

A–M are β_1 -selective (Atenolol to Metoprolol)

N–Z are Non-selective (Nadolol to Propranolol)