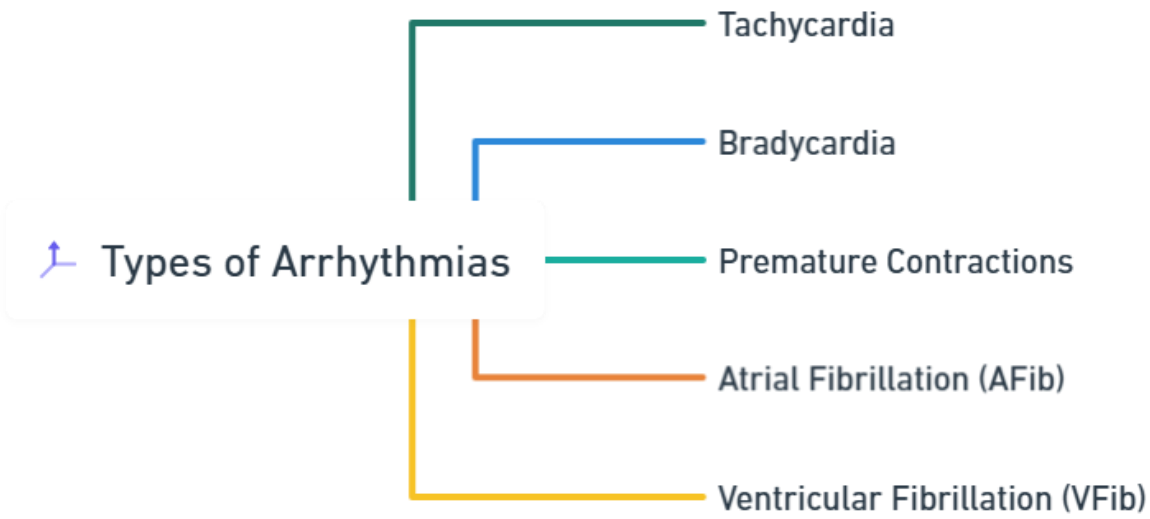
Anti-Arrhythmic Drugs

Arrhythmia

Definition:

- Arrhythmia is an irregular heart rhythm, causing the heart to beat too fast, too slow, or erratically, impacting its blood-pumping efficiency.

Types of Arrhythmias:



1. **Tachycardia:** Fast heart rate (>100 bpm), e.g., Atrial fibrillation, Ventricular tachycardia.
2. **Bradycardia:** Slow heart rate (<60 bpm), e.g., Sinus bradycardia, Heart block.
3. **Premature Contractions:** Early beats (PACs, PVCs).
4. **Atrial Fibrillation (AFib):** Irregular, rapid beats from the atria.
5. **Ventricular Fibrillation (VFib):** Chaotic, life-threatening rhythm from the ventricles.

Causes:

- Coronary artery disease, electrolyte imbalances, high blood pressure, heart valve disorders, congenital defects, lifestyle factors (e.g., caffeine, alcohol), and certain medications.

Symptoms:

- Palpitations, dizziness, shortness of breath, chest pain, and fainting (in severe cases).

Diagnosis:

- ECG, Holter monitor, event recorder, echocardiogram, and electrophysiological studies.

Treatment:

1. **Lifestyle Modifications:** Limit caffeine/alcohol, manage stress, quit smoking.
2. **Medications:** Anti-arrhythmias, beta-blockers, calcium channel blockers.
3. **Medical Procedures:** Electrical cardioversion, pacemaker, ICD, catheter ablation.

4. **Surgical Interventions:** Maze procedure to guide electrical signals.

Anti-Arrhythmic Drugs

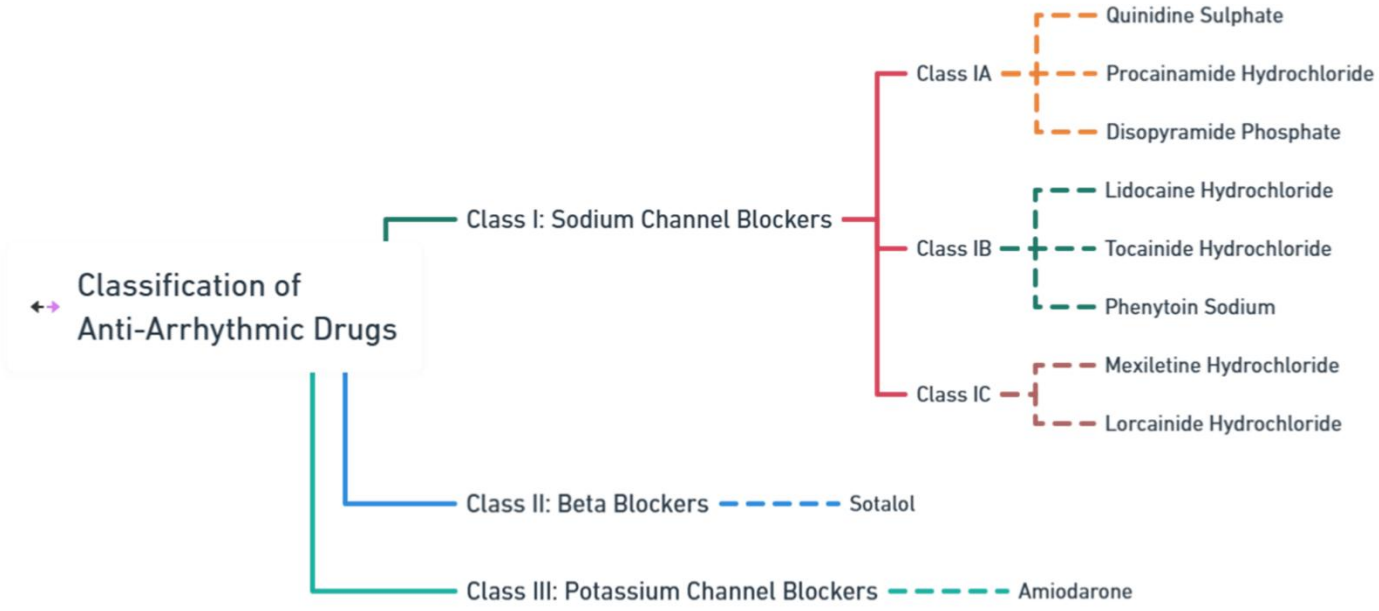
- Anti-arrhythmic drugs are medications used to treat and prevent abnormal heart rhythms (arrhythmias).
- These drugs work by modifying the electrical activity of the heart to restore and maintain a normal heart rhythm, thereby ensuring efficient blood circulation throughout the body.

Pathophysiology of Arrhythmias

- Arrhythmias occur due to disturbances in the normal electrical conduction system of the heart. These disturbances can result from:
  - **Enhanced Automaticity**: Increased spontaneous depolarization of cardiac cells.
  - **Triggered Activity**: Abnormal depolarizations during or after repolarization.
  - **Reentrant Circuits**: Circular electrical pathways that perpetuate abnormal rhythms.
- Anti-arrhythmic drugs aim to correct these disturbances by targeting various aspects of cardiac electrophysiology.

Classification of Anti-Arrhythmic Drugs

Anti-arrhythmic drugs are primarily classified according to the **Vaughan Williams Classification**, which categorizes these medications based on their primary mechanism of action on cardiac cells.



1. Class I: Sodium Channel Blockers

- These drugs inhibit sodium (Na^+) channels, reducing the rate of rise of the action potential (phase 0) in cardiac cells.
- They are further subdivided into:

A. Class IA

- **Mechanism**: Moderate blockade of Na^+ channels; also block potassium (K^+) channels, prolonging action potential duration and refractory period.
- **Drugs**:
  - Quinidine Sulphate
  - Procainamide Hydrochloride
  - Disopyramide Phosphate
- **Uses**: Atrial and ventricular arrhythmias.
- **Side Effects**: Prolonged QT interval, torsades de pointes, hypotension.

B. Class IB

- **Mechanism**: Mild blockade of Na^+ channels; shorten action potential duration and refractory period.
- **Drugs**:
  - Lidocaine Hydrochloride
  - Phenytoin Sodium
  - Tocainide Hydrochloride
- **Uses**: Ventricular arrhythmias, especially post-myocardial infarction.
- **Side Effects**: CNS toxicity (e.g., seizures, tremors), numbness.

C. Class IC

- **Mechanism**: Potent blockade of Na^+ channels with minimal effect on action potential duration.
- **Drugs**:
  - Mexiletine Hydrochloride
  - Lorcainide Hydrochloride
- **Uses**: Atrial and ventricular arrhythmias.
- **Side Effects**: Bradycardia, hypotension, proarrhythmic effects.

2. Class II: Beta Blockers

➢ These drugs block beta-adrenergic receptors, decreasing the effects of sympathetic stimulation on the heart.

- **Mechanism**: Reduce heart rate, myocardial contractility, and conduction velocity through the atrioventricular (AV) node.
- **Drugs**:
  - **Sotalol**
- **Uses**: Atrial fibrillation, ventricular arrhythmias, prevention of arrhythmic recurrence.

- **Side Effects**: Bradycardia, hypotension, fatigue, bronchoconstriction.

3. Class III: Potassium Channel Blockers

➢ These drugs primarily block K^+ channels, leading to prolonged repolarization and extended action potential duration.

- **Mechanism**: Prolong the QT interval and the refractory period without affecting Na^+ or Ca^{2+} channels significantly.
- **Drugs**:
  - Amiodarone
- **Uses**: Atrial fibrillation, ventricular tachycardia, ventricular fibrillation.
- **Side Effects**: Pulmonary fibrosis, thyroid dysfunction, liver toxicity, corneal deposits.

Class	Mechanism	Drugs	Uses	Side Effects
Class I: Sodium Channel Blockers (IA)	Moderate Na^+ & K^+ blockade; prolongs action potential and refractory period	Quinidine, Procainamide, Disopyramide	Atrial and ventricular arrhythmias	Prolonged QT interval, torsades de pointes, hypotension
Class I: Sodium Channel Blockers (IB)	Mild Na^+ blockade; shortens action potential duration and refractory period	Lidocaine, Phenytoin, Tocainide	Ventricular arrhythmias, especially post-MI	CNS toxicity (seizures, tremors), numbness
Class I: Sodium Channel Blockers (IC)	Potent Na^+ blockade; minimal effect on action potential duration	Mexiletine, Lorcainide	Atrial and ventricular arrhythmias	Bradycardia, hypotension, proarrhythmic effects
Class II: Beta Blockers	Beta-adrenergic receptor blockade; reduces heart rate and AV node conduction	Sotalol	Atrial fibrillation, ventricular arrhythmias	Bradycardia, hypotension, fatigue, bronchoconstriction
Class III: Potassium Channel Blockers	K^+ channel blockade; prolongs QT interval and refractory period	Amiodarone	Atrial fibrillation, ventricular tachycardia, ventricular fibrillation	Pulmonary fibrosis, thyroid dysfunction, liver toxicity, corneal deposits

Brand Names Of Important Marketed Products

Drugs for **abnormal heart rhythms**.

Class	Drug	Brand Name(s)	Use
Class I (Na+ block)	Lidocaine	**Xylocard**	Ventricular arrhythmias
Class II (Beta-blockers)	Metoprolol	**Betaloc, Metolar**	Atrial fibrillation, SVT

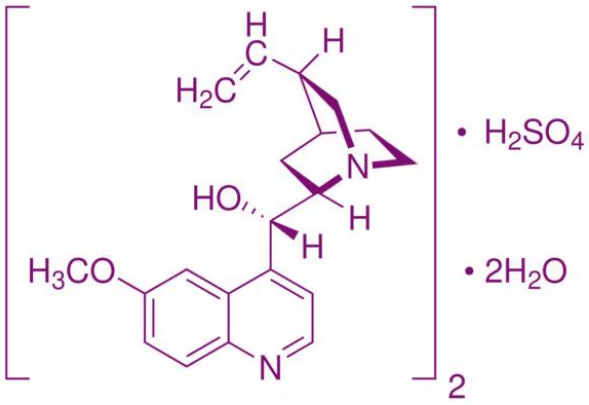
Class III (K+ block)	Amiodarone	**Cordarone, Amiodon**	VT, VF, AF
Class IV (Ca++ block)	Verapamil	**Calaptin, Isoptin**	SVT, AF
Miscellaneous	Digoxin	**Lanoxin, Digoxin**	AF with CHF

Various Class I: Sodium Channel Blockers

1. Quinidine Sulphate

Structure

- Quinidine sulphate is a stereoisomer of quinine, belonging to the class IA antiarrhythmic agents.
- It features a quinoline structure with a stereocenter that distinguishes it from quinine.
- **Chemical Formula:** $C_{24}H_{29}NO_4S$



Mode of Action

- **Class IA Antiarrhythmic:** Prolongs the action potential and refractory period by blocking fast sodium channels.
- **Ventricular and Atrial Myocytes:** Slows phase 0 of the cardiac action potential, reducing excitability.
- **Potassium Channel Blockade:** Extends repolarization by inhibiting potassium efflux.
- **Effect on Heart Rate:** Can convert atrial fibrillation to sinus rhythm and prevent reentrant arrhythmias.

Uses

- **Atrial Fibrillation and Flutter:** Restores and maintains sinus rhythm.
- **Ventricular Tachycardia:** Treats and prevents ventricular arrhythmias.
- **Prevention of Reentrant Arrhythmias:** Effective in various supraventricular and ventricular arrhythmias.
- **Antiarrhythmic Prophylaxis:** Prevents recurrence of arrhythmias post-cardiac surgery or myocardial infarction.

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