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Antiarrhythmic Pharmacology

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Pathophysiology review:

- Dysrhythmias refer to abnormal electrical activity in the heart, leading to irregular rhythms
- Any rhythm other than normal sinus rhythm is considered an arrhythmia, which can be physiologic (e.g., exercise-induced tachycardia or athlete's bradycardia) or pathologic (e.g., atrial fibrillation)
- Diagnosis is based on ECG, including 12-lead ECG or long-term monitoring like a Holter monitor
- Symptoms may include palpitations, near-syncope, dizziness, or asymptomatic presentations
- In dysrhythmias impairing perfusion (e.g., atrial fibrillation), anticoagulation is often required to reduce thromboembolic risk
- All antiarrhythmics carry a risk of causing dysrhythmias

Drug class: Class 1a antiarrhythmics – Sodium channel blockers

- Drug:
 - Procainamide
 - Quinidine
 - Disopyramide
- MOA: Moderate sodium channel blockade, prolongs action potential duration
- Indications: Supraventricular and ventricular arrhythmias
- SE/AE: Diarrhea, cardiotoxicity
- Black Box warning: Lupus like syndrome (+ANA titer), blood dyscrasias, proarrhythmic effects

Drug class: Class 1b antiarrhythmics – Sodium channel blockers

- Drug:
 - Lidocaine
- MOA: Mild sodium channel blockade, shortens action potential duration
- Indications: Ventricular arrhythmias
- SE/AE: CNS effects
- Contraindicated in patients with WPW and certain heart blocks
- Also used as an anesthetic

Drug class: Class 1c antiarrhythmics – Sodium channel blockers

- Drug:
 - Flecainide
 - Propafenone
- MOA: Strong sodium channel blockade, minimal effect on action potential duration
- Indications: Supraventricular arrhythmias, (contraindicated in structural heart disease)

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- Black Box warning: Proarrhythmic effects, consideration for increased mortality

Drug class: Beta adrenergic antagonists (Beta blockers)

- Drugs:
 - Nonselective:
 - Propranolol
 - Cardiosselective:
 - Metoprolol
 - Atenolol
 - Esmolol
 - Non-selective with vasodilating effects:
 - Labetalol
 - Carvedilol
- MOA: Blocks beta one receptors, reducing cardiac chronotropy and inotropy
- Indications: Angina, HTN, heart failure, AMI, dysrhythmias, migraines prevention, anxiety
 - Atrial fibrillation, atrial flutter, PSVT
- SE/AE: Fatigue, bradycardia, hypoglycemia, sexual dysfunction
- Black Box warning: Abrupt discontinuation can cause adverse CV effects, especially in angina
- Caution in using a nonselective with underlying pulmonary conditions
 - Can cause bronchoconstriction

Drug class: Class 3 antiarrhythmics – Potassium blockers

- Drug:
 - Amiodarone
- MOA: Prolongs repolarization
- Indications: Arrhythmias (ventricular and off-label for atrial fibrillation)
- SE/AE: Bradycardia, hypotension, arrhythmias, hepatotoxicity, pulmonary toxicity, adverse thyroid effects, skin sensitivity to light, photophobia
- Black Box warning: Proarrhythmic effects, pulmonary toxicity, hepatotoxicity
- Not safe in pregnancy
- Patient education: Avoid grapefruit juice, can cause toxicity
- Duration can last for months

Drug class: Class 4 antiarrhythmics – Calcium channel blockers

- Drug:
 - Verapamil
 - Diltiazem
- MOA: Relaxation of vascular smooth muscle and vasodilation also decreases cardiac cellular excitability and contractility
- Indications: Arrhythmias (atrial fibrillation, atrial flutter, and PSVT), HTN, angina
- SE/AE: Dysrhythmias
- Non-dihydropyridines only

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Drug class: Cardiac glycosides

- Drug:
 - Digoxin (Lanoxin)
- MOA: Increased effects of calcium resulting in increased contractility
- Indications: Dysrhythmias (atrial fibrillation and flutter) and HF with reduced EF (HFrEF)
- SE/AE: Nausea and vomiting, visual disturbances (notably halos), bradycardia, dysrhythmias
- Patients should have heart rate, rhythm and digoxin levels monitored when initiating treatment
- Antidote available for digoxin toxicity called digoxin-immune fab

Drug name: Adenosine (Adenocard)

- MOA: Decreases automaticity and slows conduction
- Indications: Tachydysrhythmia treatment and diagnostics
- Patients must be on a cardiac monitor and should have a running ECG strip printing
 - Serves a diagnostic purpose even if arrhythmia returns
 - Dosage is typically 6mg with an optional one or two repeat doses at 6mg or 12mg
- Onset is a few seconds, and duration is under 10 seconds
 - Should be administered as centrally as possible
- SE/AE: Transient asystole and chest discomfort
- Also referred to as chemical conversion

Treatment notes:

- Electrical treatments include cardioversion (synchronized shock for tachyarrhythmias like atrial fibrillation), defibrillation (unsynchronized shock for life-threatening arrhythmias like ventricular fibrillation), and pacemaker implantation (to address bradycardia or heart block)
- Advanced options like implantable cardioverter defibrillators (ICDs) are used for patients at risk of sudden cardiac arrest, while catheter ablation uses radiofrequency energy or cryotherapy to disrupt abnormal electrical pathways
- Magnesium and other electrolytes may be the cause and/or treatment for dysrhythmias
- Any patient with a dysrhythmia and/or starting an antiarrhythmic should be on a cardiac monitor when in the acute care setting

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