ARRHYTHMIA PHARMACOLOGY

University of Hawai‘i Hilo Pre-Nursing Program
NURS 203 – General Pharmacology
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LEARNING OBJECTIVES

- Understand what arrhythmias are and differentiate between the different types
- Know the characteristics of the drugs in the different arrhythmia treatment groups
- Know amiodarone
- Know sotalol
- Know drug limited by side effects
- Know drugs with very serious side effects
**ARRHYTHMIA**

What is an arrhythmia?
- An irregular heart beat

What are the types of arrhythmias?

1. **Automaticity Abnormality**
2. **Conductivity Abnormality**
   - Delay or Block
   - Re-entry
ARRHYTHMIA — DISTURBANCE IN AUTOMATICITY

Pacemaker cells:
- Create their own electrical impulses
- Do not require chemical messengers, electrical impulses, or nearby action potentials

Regular heart rate is 60-100 bpm
- Decrease in pacemaker activity
  - Bradycardia (less than 60 bpm)
- Increase in pacemaker activity
  - Tachycardia (more than 100 bpm)

Ectopic pacemaker activity
- Impulse formation in the SA node happens “regularly”
- Shift in the impulse formation creates “irregular” rate or rhythm
ARRHYTHMIA — DISTURBANCES OF CONDUCTIVITY

SA Block

AV block

1st

2nd

3rd
ARRHYTHMIA — RE-ENTRY

A. Normal impulse

- Re-entry is responsible for ectopic beats
- Most common type of arrhythmia
- Ectopic beats – begin somewhere other than the SA node
ARRHYTHMIAS — HOW DO WE TREAT?

There are 4 groups of anti-arrhythmic drugs

<table>
<thead>
<tr>
<th>Group I Drugs</th>
<th>Group II Drugs</th>
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<tbody>
<tr>
<td>Fast sodium channel blockers</td>
<td>Beta blockers</td>
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<tr>
<td>Increase the refractory period</td>
<td>Slow the heart rate</td>
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<td>Slow the heart rate</td>
<td>Reduce SNS stimulation</td>
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<tr>
<th>Group III Drugs</th>
<th>Group IV Drugs</th>
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<tbody>
<tr>
<td>Prolong cardiac repolarization</td>
<td>Block calcium channels</td>
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<td></td>
<td>Decrease automaticity</td>
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<td></td>
<td>Decrease smooth muscle &amp; cardiac</td>
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<td></td>
<td>contraction</td>
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<td>Decrease conduction velocity</td>
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ARRHYTHMIA — GROUP I DRUGS

Group I Drugs
Fast sodium channel blockers
Increase the refractory period
Slow the heart rate

Group I A
Disopyramide, procainamide, quinidine
Interfere Na influx at phase 0
Slows the speed of depolarization
Slows conduction velocity
Widened QRS/prolonged QT on EKG

Group I B
Lidocaine, tocainide, mexiletine
Increase or no effect on conduction velocity
Mexiletine limited by ADRs
Tocainide can cause agranulocytosis

Group I C
Flecainide & propafenone
Used for life threatening supraventricular tachyarrhythmias
Can cause sinus arrest — use with extreme caution
**ARRHYTHMIA — GROUP I DRUGS**

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<tr>
<th>Group I A</th>
<th>Disopyramide, procainamide, quinidine</th>
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<tr>
<td><strong>Group I B</strong></td>
<td>Agranulocytosis = Decreased WBC neutrophil deficiency (neutropenia) decreased ability to fight infection (tocainide)</td>
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<tr>
<td><strong>Group I C</strong></td>
<td>Sinus Arrest</td>
</tr>
</tbody>
</table>

- **Cardiac cycle**
  - **Normal**
  - **Wide QRS/prolonged QT on EKG**
ARRHYTHMIA — GROUP II DRUGS (BETA BLOCKERS)

Acebutolol

- Beta 1 selective with modest ISA
- Used for: Ventricular dysrhythmia
  - Can stop ectopic beats
  - Angina and HTN
- High first pass effect
- ADRs: Can cause AV block

Esmolol

- Beta 1 selective
- Very short acting
- Used for: Atrial fibrillation/flutter, supraventricular tachycardia (SVT), operative HTN
- IV bolus and infusion
- ADRs: Nausea, hypotension, sweating
ARRHYTHMIA — GROUP III DRUGS

Bretylium
Amiodarone
Dofetilide
Sotalol

Prolong the refractory period
- Time until the next depolarization

Block potassium channels

Prolong QT interval – can cause ventricular dysrhythmias
ARRHYTHMIA — GROUP III DRUGS

Amiodarone — most commonly used group III agent

MOA: Increase refractory period all cardiac tissues, decrease automaticity, prolong AV conduction, decrease automaticity in Purkinje fibers

Uses: Life threatening ventricular fibrillation and ventricular tachycardia, atrial fibrillation conversion to NSR, paroxysmal supraventricular tachycardia (PSVT)

MAJOR ENZYME INHIBITOR (GPACMAN)

Substrate for CYP enzymes

Long half life (26-107 days)

ADRs: Bradycardia, heart block heart failure, hepatic & pulmonary toxicity, dizziness, visual disturbances, etc.
ARRHYTHMIA — GROUP III DRUGS

Sotalol — unusual beta 1 selective agent that also blocks potassium channels

Used for: Life threatening ventricular arrhythmias
  - Betapace AF – afib

Well absorbed, excreted in urine as unchanged drug

ADRs: Torsades de pointes / QT prolongation and fatigue, dizziness, weakness, dyspnea, confusion, headache, N&V

Torsades de Pointes