

A Review of Antiarrhythmic Agents

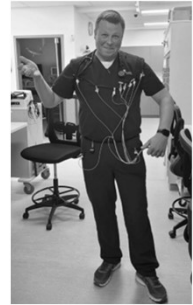
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Outline

- Classification System Review
- Common Arrhythmia Overview
 - Acute Therapy of Arrhythmias
 - Chronic Therapy of Arrhythmias
- Questions and Discussion

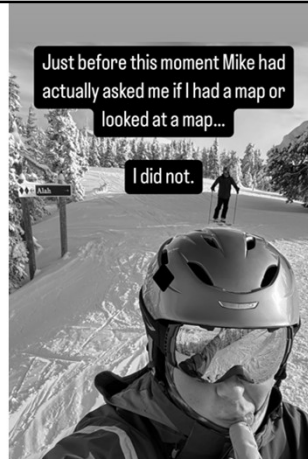


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Classification System

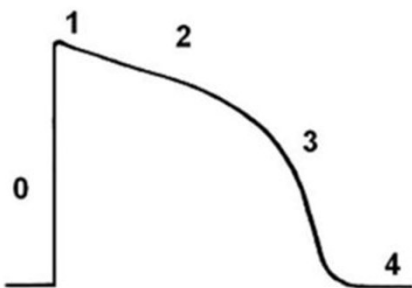
- Vaughn-Williams Classification System
 - Classified based on predominant effect on the action potential
- Sicilian Gambit (SG) System
 - Classified based on action of drug on arrhythmogenic mechanism

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Action Potential



From: Bonow, Braunwald's Heart Disease, 9th Edition

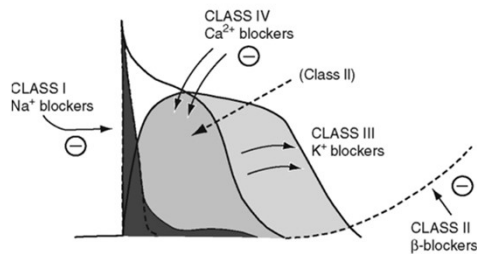
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Vaughn-Williams System

	Class I	Sodium Channel Blockers
	Class II	Beta-adrenergic antagonists
	Class III	Potassium-Current Blockers ("Mixed Blockers")
	Class IV	Calcium Channel Blockers

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Effects of Antiarrhythmics

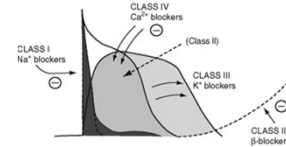


From: Opie, Drugs for the Heart 7th Edition

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Class I

- Block fast sodium channel (slows re-entry)
 - Phase 0 suppression
- Best effect on:
 - Purkinje Cells
 - Ventricular Myocardial Cells



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Class I Antiarrhythmics

- Class I A
 - Procainamide, Quinidine, Disopyramide
- Class I B
 - Lidocaine, Mexiletine, Tocainide
- Class I C
 - Flecainide, Propafenone

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Procainamide

- Markedly depress Phase 0 of the action potential
- Slows electrical impulse conduction
- Prolongs effective refractory period
- Useful in:
 - Ventricular Tachycardia
 - Supraventricular Tachycardia
 - Sudden Onset SVT or Atrial Fibrillation

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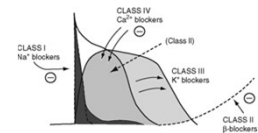
Lidocaine / Mexilitine

- Block Fast Sodium Channel
 - Decrease slope of Phase 0
 - Depress automaticity
 - Increases threshold for ventricular fibrillation
 - Selectively bind inactivated sodium channels
- Useful for ischemic/diseased ventricular myocytes

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Class II

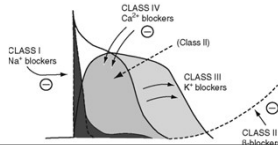
- Major Veterinary Agents:
 - Propranolol (Nonselective)
 - Atenolol (Selective β_1)
 - Esmolol (Injectable β_1)
- Suppress arrhythmogenic effects of beta-receptors stimulation
 - Negative Effects:
 - Chronotropic (Heart Rate)
 - Inotropic (Contractility)
 - Dromotropic (AV Node Transit)



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Class III

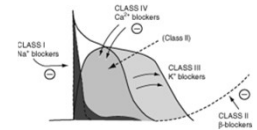
- Major Veterinary Agents:
 - Sotalol
 - Amiodarone
- Prolong action potential and refractory period
 - I_K inhibition
 - Reduced ability to form a new action potential
 - Sotalol – reverse-use dependency



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Class IV

- Major Veterinary Agents:
 - Diltiazem
- Inhibit L-Type Calcium Channels
 - Interrupt re-entry
 - Suppress abnormal automaticity/triggered activity
- Slow Sinus Rate
- Slow AV Nodal Conduction
- Negative Inotrope
 - Inhibit SR calcium release



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Diltiazem Sidebar

- Standard Strength
 - 30, 60, 90, 120 mg *Tablets*
- Extended Release (XR, ER, CR)
 - 90, 240 mg *Capsules*
 - Inside Capsules are 60mg *Tablets*
 - Careful prescribing and warn owners!
 - Air sensitive, should be kept inside capsule

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Digoxin

- Cardiac Glycoside
- Positive Inotrope
 - Increased Intracellular Calcium Level
- Negative Chronotrope
 - Direct and Indirect Vagal Modulation
- Recheck Digoxin Levels
 - 8 Days, 8 Hours Post-Pill
 - Desired Level: 0.8-1.5 ng/mL

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Common Arrhythmias

- Ventricular
 - Ventricular Premature Complexes / Tachycardia
 - Accelerated Idioventricular Rhythm
 - Ventricular Pre-Excitation (Wolff-Parkinson-White)
- Supraventricular
 - Atrial Fibrillation
 - Atrial Premature Complexes
 - Supraventricular Tachycardia (SVT)

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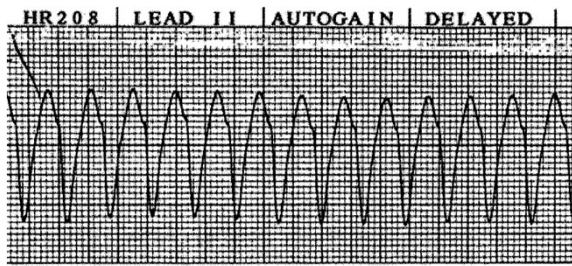
Ventricular Premature Complexes

- Criteria For Treatment:
 - Ventricular Tachycardia (HR >180 bpm)
 - Multifocal
 - Non-Conducting
 - R-on-T Phenomenon



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Ventricular Tachycardia



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Accelerated Idioventricular Rhythm

- Competing ventricular and sinus node foci
 - Often associated with abdominal disease (spleen, liver) or trauma (HBC)



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VPCs and Ventricular Tachycardia

Etiologies		
Hypoxia	Pain	Electrolytes
Ischemia	Sepsis	Trauma
Pancreatitis	Cardiac Disease	GDV

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VPC and V-Tach Therapy

- Acute Therapy
 - Lidocaine: 2 mg/kg IV Bolus
 - CRI Dose: 50 mcg/kg/min
 - Procainamide: 2-10 mg/kg IV SLOW Bolus (5)
 - CRI Dose: 25 mcg/kg/min
- Chronic Therapy
 - Mexiletine: 4-8 mg/kg PO q8h
 - Procainamide: 10 mg/kg PO q8h
 - Sotalol: 2-3 mg/kg PO q12h
 - Atenolol: 0.5 - 1 mg/kg PO q12h

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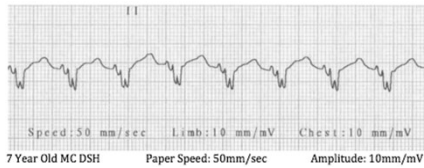
Class I Antiarrhythmic Pearls

- Lidocaine and Procainamide are both Class I
 - 2 Doses Lidocaine
 - 2 Doses Procainamide
 - Seizures possible if more doses are given
- Potassium must be normal to be effective
 - If hypokalemic, correct it! (≤ 0.5 mEq/kg/hr maximum!)
 - If potassium cannot be corrected, magnesium might be low!

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Ventricular Pre-Excitation

- Early Activation of the Ventricle
 - Accessory pathway allows bypass of AV Node



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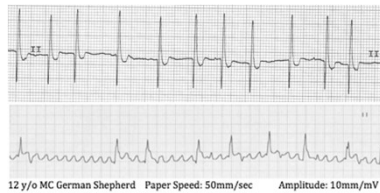
Ventricular Pre-Excitation Therapy

- Acute Therapy
 - Diltiazem 0.25 mg/kg IV Slowly (2 mins)
 - Esmolol 0.05-0.1 mg/kg IV Slowly (2 mins)
 - Procainamide 5 mg/kg IV SLOW bolus
- Chronic Therapy
 - Diltiazem XR 2-3 mg/kg PO q12h
 - Diltiazem 1-2 mg/kg PO q8h
 - Procainamide 10 mg/kg PO q8h
 - Atenolol 0.5-1 mg/kg PO q12h
 - Digoxin CONTRAINDICATED

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Atrial Fibrillation / Flutter

- Typical Etiology
 - Severe atrial dilation
 - Congestive Heart Failure very likely!
- Occasionally
 - Lone Atrial Fibrillation (Irish Wolfhounds)



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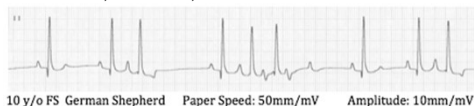
Atrial Fibrillation Therapy

- Acute Onset A-Fib
 - Procainamide 5 mg/kg IV SLOW Bolus
- Acute Therapy – CHF
 - Diltiazem XR 1-2 mg/kg PO q12h
 - Diltiazem 0.5-1 mg/kg PO q8h
 - Lasix, Enalapril, Pimobendan
- Chronic Therapy - CHF
 - Diltiazem XR 1-2 mg/kg PO q12h
 - Diltiazem 0.5-1 mg/kg PO q8h
 - Digoxin 0.003 mg/kg PO q12h

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Atrial Premature Complexes

- Etiology
 - Dilated Atria
 - Mechanical Irritation (Infection, Neoplasia)
- Acute Therapy
 - Procainamide Rarely Necessary
- Chronic Therapy
 - Treat Underlying Disease
 - Diltiazem, Atenolol, Procainamide



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Supraventricular Tachycardia

- Etiologies
 - Accessory pathway or re-entry mechanisms
 - Atrial Irritation or Ectopic Foci



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Supraventricular Tachycardia

- Acute Therapy
 - Vagal Maneuvers Ocular or Carotid Massage
 - Procainamide 6-8 mg/kg IV SLOW Bolus
 - Diltiazem 0.25 mg/kg IV Slowly (2 Mins)
 - Esmolol 0.05-0.1 mg/kg IV Slowly (2 Mins)
- Chronic Therapy
 - Diltiazem XR 2 mg/kg PO q12h
 - Diltiazem 0.5-1 mg/kg PO q8h
 - Procainamide 10 mg/kg PO q8h
 - Atenolol 0.5-1 mg/kg PO q12h

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Atrioventricular Block

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Atrioventricular Blocks

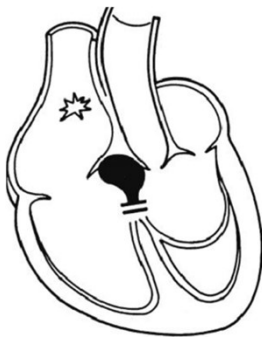


Image from VIN.com - Kittleson

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Atrioventricular Blocks

1st Degree AV Block

- Prolonged PR Interval

2nd Degree AV Block

- Dropped QRS Complexes
 - Mobitz Type I
 - Mobitz Type II

3rd Degree AV Block

- Complete AV Dissociation
- P-waves "marching through"
- Ventricular Escape Rhythm
- HR: ~35-40 bpm

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1st Degree AV Block



http://www.pacemakerproject.com/assets/img/first_deg_AV.jpg (Sponsored by Medtronic, Minneapolis, MN)

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2nd Degree AV Block

- Mobitz Type I (Wenckebach)



Image from VIN.com - Kittleson: Textbook of Small Animal Cardiovascular Disease

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2nd Degree AV Block

- Mobitz Type II



Image from VIN.com - Kittleson: Textbook of Small Animal Cardiovascular Disease

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3rd Degree AV Block

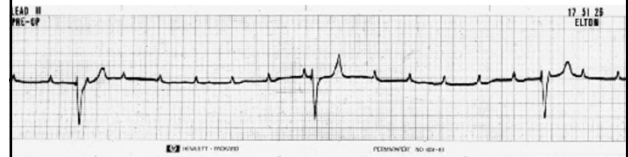


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Sinus Arrest

- NSR with periods of prolonged pause
- "Sick Sinus Syndrome"
 - Miniature Schnauzers predisposed
 - Syncope
- Pause > 2 RR intervals



Image from VIN.com

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Etiologies

High Vagal Tone

- Gastrointestinal Disease
- Respiratory Disease
- Neurologic Disease

Neoplastic Disorders

- Hemangiosarcoma
- Lymphosarcoma

Idiopathic

- SSS Schnauzers

Inflammatory

- Implicated
- Atrioventricular Myopathy

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Atropine Response Test

Rationale

- Parasympatholytic

Technique

- Atropine 0.04 mg/kg IM
- Repeat ECG in 20 mins
- If unchanged, failed test
- If sinus (or close), passed test

If responsive

- Consider medical management
- Theophylline
- 10-15 mg/kg PO q12h



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General Guidelines for Pacemakers

- Rhythms
 - High-grade 2nd Degree AV Block
 - >2:1 conduction
 - 3rd Degree AV Block
 - Sinus Arrest
- Patient
 - Syncope present
 - Severe exercise intolerance
 - Congestive Heart Failure
 - Prolonged Bradycardia

**BEFORE YOU REFER...
DO NOT STICK A JUGULAR VEIN**

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