

# Drugs That Affect The Heart

## NAPNES Guidelines

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# Positive Inotropic agents Definition

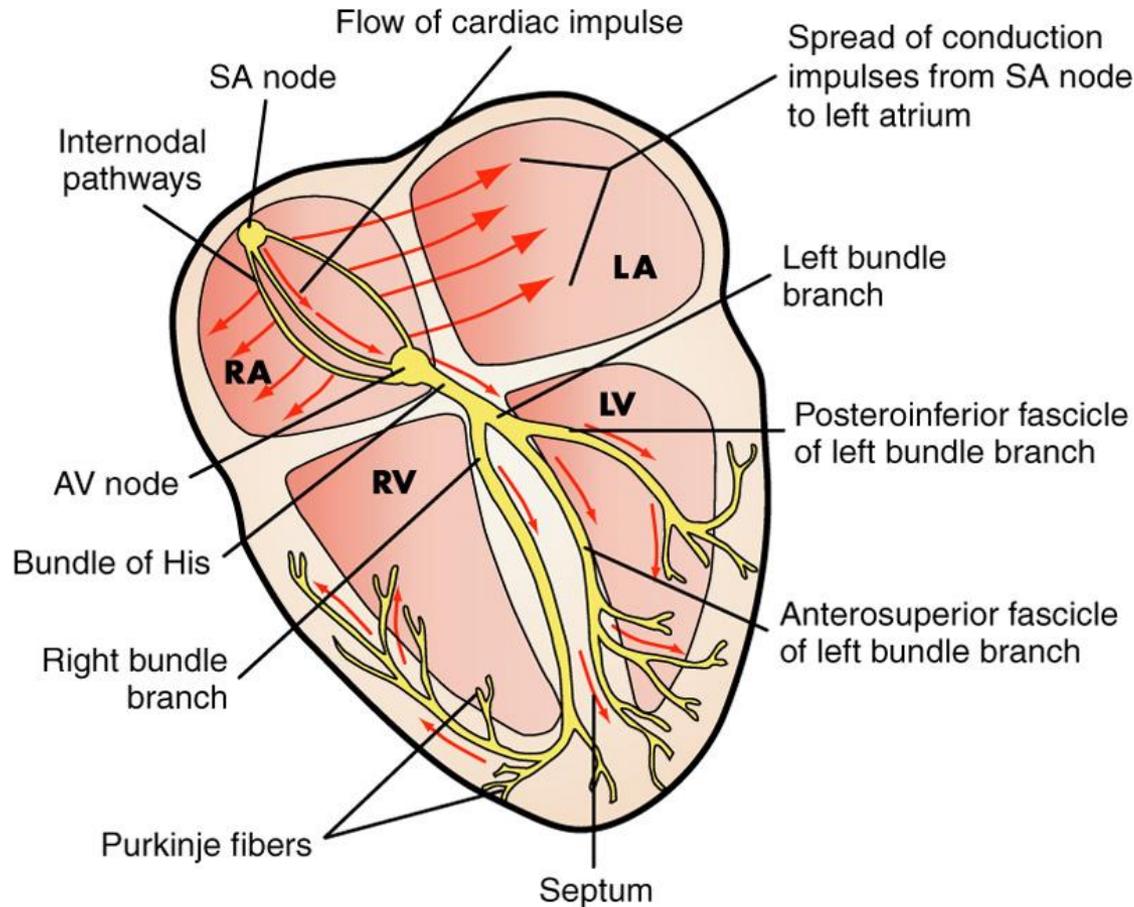
- Drugs that increase the force of myocardial contraction
- Used to treat heart muscle failure
- Cardiac glycosides
  - digoxin

# Heart Failure

- The heart is unable to pump blood in sufficient amounts from the ventricles to meet the body's metabolic needs
  - Symptoms depend on cardiac area affected
    - Left ventricular failure
    - Right ventricular failure
- \*Mainly used for systolic dysfunction, not always drug of choice for diastolic dysfunction

# Heart Failure: Causes

- Cardiac defect
  - MI
  - Valve deficiency
- Defect outside the heart
  - Coronary artery disease
  - Pulmonary hypertension
  - Diabetes
- Supraventricular dysrhythmias
  - Atrial fibrillation
  - Atrial flutter



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Figure 21-1 Conduction system of the heart. AV, Atrioventricular; LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle; SA, sinoatrial. (Modified from Kinney M et al: *Comprehensive cardiac care*, ed 8, St. Louis, 1996, Mosby. In Lewis SM, Heitkemper MM, Dirksen SR: *Medical-Surgical Nursing: Assessment and Management of Clinical Problems*, ed 6, St. Louis, 2004, Mosby.)

# Cardiac Glycosides

- Oldest and most effective group of drugs
- Originally obtained from foxglove
  - *Digitalis purpurea* plant
  - *Digitalis lanata* plant
- Digoxin (Lanoxin)
  - Most commonly prescribed
- Used in heart failure and to control ventricular response to atrial fibrillation or flutter

# Cardiac Glycosides

- Usual digitalizing dose
  - 1 to 1.5 mg/day
  - Higher dose to get adequate blood level
- Usual maintenance dose
  - 0.125 to 0.5 mg/day

# Cardiac Glycosides: Mechanism of Action

- Increase myocardial contractility
- Change electrical conduction properties of the heart
  - Decrease rate of electrical conduction
  - Prolong the refractory period
    - Area between SA node and AV node

# Drug Effects:

## General terms

- Inotropic
  - Force or energy of muscular contractions
- Chronotropic
  - Rate of the heartbeat
- Dromotropic
  - The conduction of electrical impulses

# Cardiac Glycosides: Drug Effects

- Positive inotropic effect
  - Increase in force and velocity of myocardial contraction (without an increase in oxygen consumption)
- Negative chronotropic effect
  - Reduced heart rate
- Negative dromotropic effect
  - Decreases automaticity at SA node; decreases AV nodal conduction, and other effects

# Cardiac Glycosides: Drug Effects (cont'd)

- Increased stroke volume
- Reduction in heart size during diastole
- Decrease in venous BP and vein engorgement
- Increase in coronary circulation
- Promotion of diuresis due to improved blood circulation
- Palliation of exertional and paroxysmal nocturnal dyspnea, cough, and cyanosis

# Cardiac Glycosides: Indications

- Heart failure
- Supraventricular dysrhythmias
  - Atrial fibrillation and atrial flutter

# Cardiac Glycosides: Side/Adverse Effects

- digoxin (Lanoxin)
  - Very narrow therapeutic window
  - Drug levels must be monitored
    - Therapeutic – 0.5 to 2 ng/mL
  - ***Low potassium*** levels increase its toxicity
  - Electrolyte levels must be monitored

# Digoxin:

## Side/Adverse Effects

- Cardiovascular
  - Dysrhythmias, including bradycardia or tachycardia
- CNS
  - Headaches, fatigue, malaise, confusion, convulsions

# Digoxin:

## Side/Adverse Effects (cont'd)

- Eye
  - Colored vision (seeing green, yellow, purple), halo vision, flickering lights
- GI
  - Anorexia, nausea, vomiting, diarrhea

# Digoxin Toxicity

- digoxin immune Fab (**Digibind**) therapy
  - Hyperkalemia (serum potassium  $>5$  mEq/L) in a digitalis-toxic patient
  - Life-threatening cardiac dysrhythmias
  - Life-threatening digoxin or digitoxin overdose

# Positive Inotropic Agents: Nursing Implications

- Assess history, drug allergies, contraindications
- Assess clinical parameters, including:
  - BP
  - Apical pulse for 1 full minute
  - Heart sounds, breath sounds

# Positive Inotropic Agents: Nursing Implications

- Assess clinical parameters (cont'd)
  - Weight, I&O measures
  - ECG
  - Serum labs: potassium, sodium, magnesium, calcium, renal and liver function studies

# Positive Inotropic Agents: Nursing Implications

- Before giving any dose, count apical pulse for 1 full minute
- For apical pulse  $<60$  or  $>120$  beats/minute
  - Hold dose
  - Notify prescriber

# Positive Inotropic Agents: Nursing Implications

- Hold dose and notify prescriber if patient experiences signs/symptoms of toxicity
  - Anorexia, nausea, vomiting, diarrhea
  - Visual disturbances (blurred vision, seeing green or yellow halos around objects)

# Positive Inotropic Agents: Nursing Implications

- Check dosage forms carefully, and follow instructions for giving
- Avoid giving digoxin with high-fiber foods (fiber binds with digitalis)
- Patients should report immediately a weight gain of 2 or more pounds in 1 day or 5 or more pounds in 1 week

# Positive Inotropic Agents: Nursing Implications

- Monitor for therapeutic effects
  - Increased urinary output
  - Decreased edema, shortness of breath, dyspnea, rales, fatigue
  - Resolving of paroxysmal nocturnal dyspnea
  - Improved peripheral pulses, skin color, temperature
- Monitor for adverse effects

# Antidysrhythmic Agents

# Antidysrhythmics

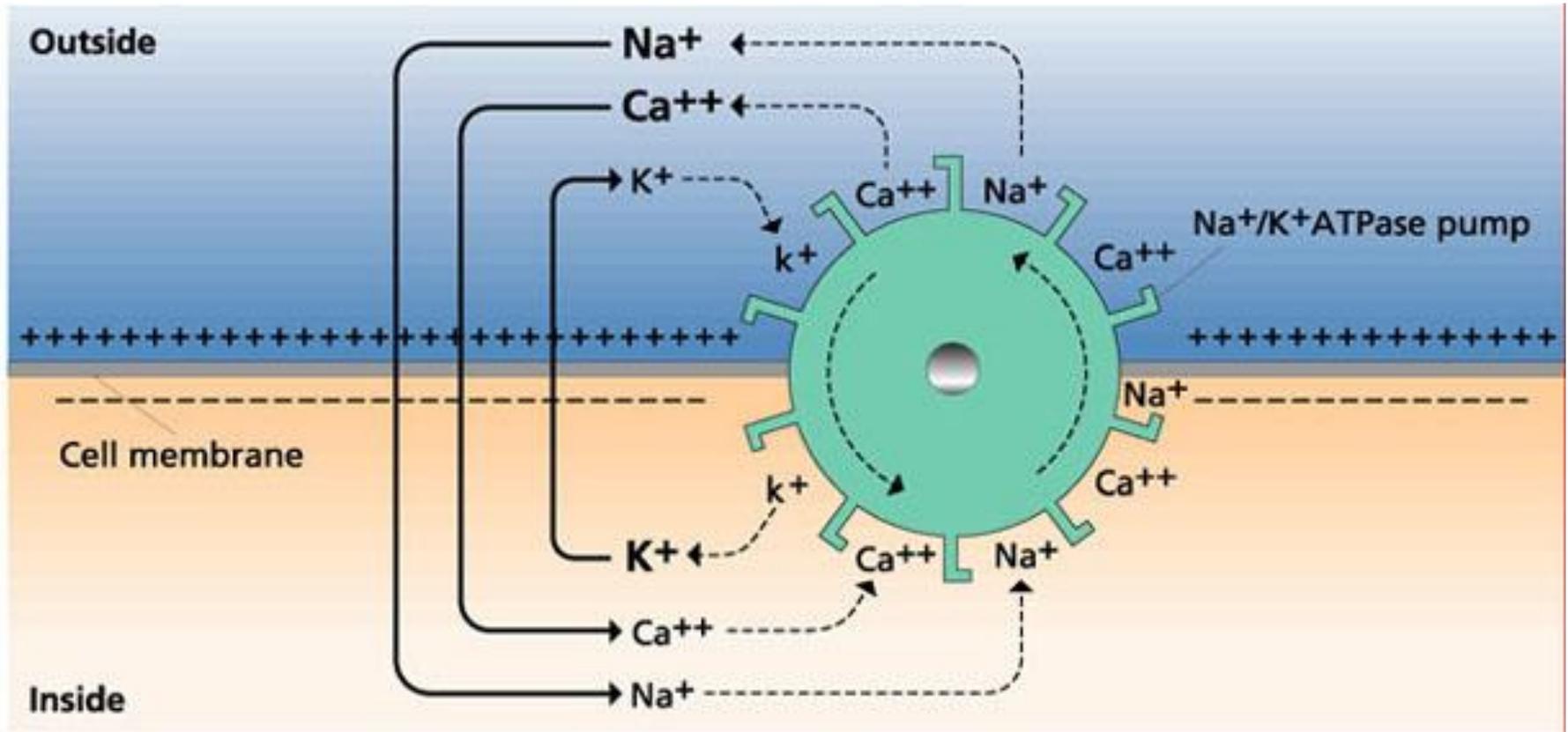
## Dysrhythmia

- Any deviation from the normal rhythm of the heart

## Antidysrhythmics

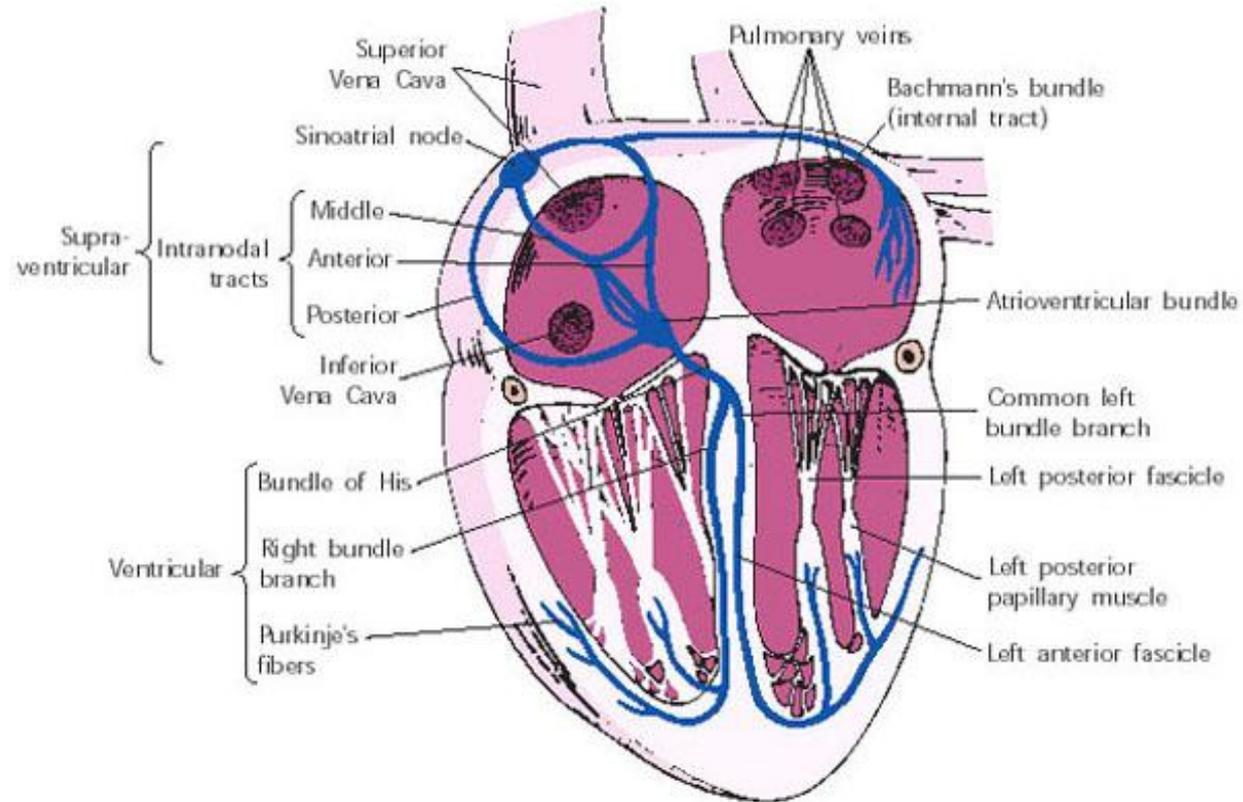
- Drugs used for the treatment and prevention of disturbances in cardiac rhythm

# Resting Membrane Potential of a Cardiac Cell



# Action Potential SuperHighway

- Sinoatrial node
- Atrioventricular node
- Bundle of His
  - Fascicles
- Purkinje Network

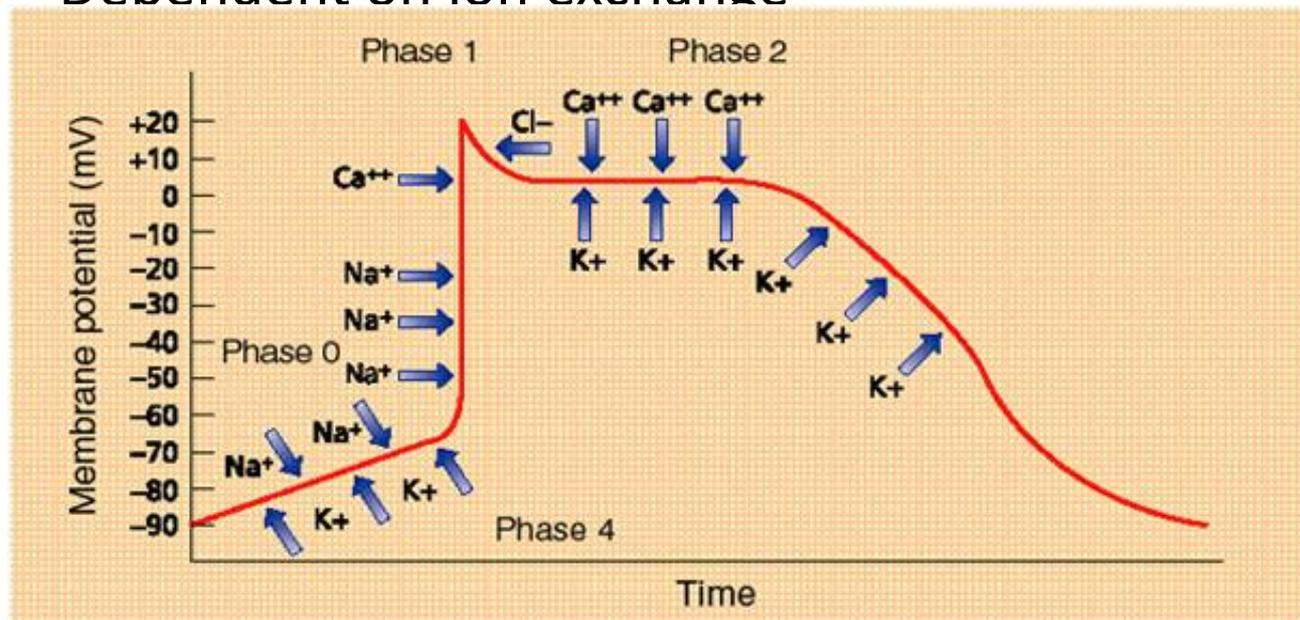


# Dysrhythmia

- Any abnormality in cardiac automaticity or impulse conduction
- Some causes
  - Electrolyte imbalance
  - Myocardial infarction
  - Disturbances in conduction pathway
    - Ectopic foci

# Vaughan Williams Classification

- System commonly used to classify antidysrhythmic drugs
  - Drugs affect different phases of contraction of heart
- Dependent on ion exchange



# Vaughan Williams Classification

- Class 1
  - Class Ia
  - Class Ib
  - Class Ic
- Class II
- Class III
- Class IV
- Other

# Antidysrhythmics

- Quinidine (Quinidex, Quinaglute)
  - Prototype antidysrhythmics
  - Mechanism of Action
    - Decrease heart intake of K<sup>+</sup>
    - Prolongs rest period of heart
    - Decreases heart irritability
    - Decreases vagus nerve activity (anticholinergic)
  - SE
    - Asystole
    - Ventricular ectopic beats

# Antidysrhythmics (cont.)

- Quinidine (cont.)
  - Can cause ***cinchonism*** – inform MD
    - Tinnitus
    - Hearing loss
    - Blurred vision
    - Headache
    - Dizziness

# Antidysrhythmics (cont.)

- Other Examples
  - Procainamide HCL (Pronestyl)
  - Lidocaine HCL (Xylocaine)
  - Propranolol HCL (Inderal)
  - Digoxin (Lanoxin)

# Antidysrhythmics (cont.)

- Examples
  - quinidine, procainamide (Pronestyl), disopyramide (Norpace)
- Indications
  - Supra ventricular arrhythmias
    - Atrial fibrillation, premature atrial contractions, Wolff-Parkinson-White syndrome
  - Ventricular arrhythmias
    - Premature ventricular contractions, ventricular tachycardia,

# Antidysrhythmics (cont.)

- Example
  - Lidocaine
- Used for ventricular dysrhythmias only
  - Premature ventricular contractions
  - Ventricular tachycardia
  - Ventricular fibrillation

# Antidysrhythmics: Beta-blockers

- Examples

- atenolol, esmolol, metoprolol, propranolol

- Mechanism of Action

- Reduce or block sympathetic nervous system stimulation,
  - Reducing transmission of impulses in the heart's conduction system

- General myocardial depressants

- Supraventricular (above the ventricles)
- Ventricular dysrhythmias

# Antidysrhythmics: Calcium Channel Blockers (CCB)

- Mechanism of action
  - Reduces inward current of calcium ions across cell membrane
  - Decrease SA/AV automaticity
  - Decrease AV conductivity
  - Useful in breaking re-entrant circuit
- Examples
  - verapamil (Calan<sup>®</sup>)
  - diltiazem (Cardizem<sup>®</sup>)

Note: Other CCB like nifedipine and others don't work on heart, are used for blood pressure control

# Antidysrhythmics: Calcium Channel Blockers (CCB)

- Side Effects
  - Cardiovascular
    - hypotension, bradycardia
    - palpitations & tachycardia
  - Gastrointestinal
    - **constipation** & nausea
  - Other
    - rash, flushing & **peripheral edema**

# Antidysrhythmics in General Side Effects

ALL antidysrhythmics can cause dysrhythmias!!

- Hypersensitivity reactions
  - Nausea
  - Vomiting
  - Diarrhea
  - Dizziness
  - Blurred vision
  - Headache

# Antidysrhythmics: Nursing Implications

- Obtain a thorough drug and medical history.
- Measure baseline BP, P, I & O, and cardiac rhythm.
- Measure serum potassium levels before initiating therapy.

# Antidysrhythmics: Nursing Implications

- Assess for conditions that may be contraindications for use of specific agents.
- Assess for potential drug interactions.
- Instruct patients regarding dosing schedules and side effects to report to physician.

# Antidysrhythmics: Nursing Implications

- During therapy, monitor cardiac rhythm, heart rate, BP, general well-being, skin color, temperature, heart and breath sounds.
- Assess plasma drug levels as indicated.
- Monitor for toxic effects.

# Antidysrhythmics: Nursing Implications

- Instruct patients to take medications as scheduled and not to skip doses or double up for missed doses.
- Patients who miss a dose should contact their physician for instructions if a dose is missed.
- Instruct patients not to crush or chew any oral sustained-release preparations.
- Inform patients that tablets or capsules may be visible in the stool
  - Wax matrix that remains after drug absorbed in intestine
  - Commonly occurs with verapamil and quinidine

# Antidysrhythmics: Nursing Implications

- Patients should be taught
  - To take their own radial pulse for 1 full minute
  - Notify prescriber
    - Pulse is less than 60 beats/minute before taking the next dose of medication.

# Antidysrhythmics: Nursing Implications

- Monitor for therapeutic response:
  - Decreased BP in hypertensive patients
  - Decreased edema
  - Regular pulse rate or
  - Pulse rate without major irregularities, or
  - Improved regularity of rhythm

# Drugs That Affect Blood Vessels

## CHAPTER 23

### Antianginal Agents

# Angina Pectoris (Chest Pain)

- When the supply of oxygen and nutrients in the blood is insufficient to meet the demands of the heart
  - Heart muscle “aches”
- Heart requires a large supply of oxygen
  - To meet the demands placed on it

# Types of Angina

- Chronic stable angina  
(also called classic or effort angina)
- Unstable angina  
(also called preinfarction or crescendo angina)
- Vasospastic angina  
(also called Prinzmetal's or variant angina)

# Antianginal Agents

- Nitrates/nitrites
- Beta-blockers
- Calcium channel blockers

# Antianginal Agents

## Therapeutic Objectives

- Increase blood flow to ischemic heart muscle

*and/or*

- Decrease myocardial oxygen demand

# Antianginal Agents

## Therapeutic Objectives (cont.)

- Minimize the frequency of attacks
- Decrease the duration and intensity of anginal pain
- Improve the patient's functional capacity with as few side effects as possible
- Prevent or delay the worst possible outcome
  - MI

# Antianginal Agents

## Nitrates/Nitrites

### Available forms

- Sublingual
- Buccal
- Chewable tablets
- Oral capsules/tablets
- Intravenous solutions
- Ointments
- Transdermal patches
- Translingual sprays

# Antianginal Agents

## Nitrates/Nitrites (cont.)

- Cause vasodilation
  - Due to relaxation of smooth muscles
- Potent dilating effect on coronary arteries
- Indications
  - Prevention and treatment of angina

# Antianginal Agents

## Nitrates/Nitrites (cont.)

- Mechanism of action
  - Relaxes smooth muscle of blood vessels
    - Nitrates cause dilation of both large and small coronary vessels
  - Vasodilation causes
    - Decreased blood volume returning to the heart
    - Reduced myocardial oxygen demand
    - Decreased workload of the heart
  - Result
    - More oxygen to ischemic myocardial tissue
  - Nitrates also alleviates coronary artery spasms

# Antianginal Agents

## Nitrates/Nitrites (cont.)

### Nitroglycerin

- Prototypical nitrate
- Large first-pass effect with oral forms
- Used for symptomatic treatment of ischemic heart conditions (angina)
- IV form
  - BP control in perioperative hypertension, treatment of HF, ischemic pain, pulmonary edema associated with acute MI, and hypertensive emergencies

# Antianginal Agents

## Nitrates/Nitrites (cont.)

- Examples
  - Oral forms
    - isosorbide dinitrate  
(Isordil, Sorbitrate, Dilatrate SR)
    - isosorbide mononitrate  
(Imdur, Monoket, ISMO)
  - Sublingual, spray
    - Nitroglycerine (NTG)
  - Transdermal patch/ointment
    - Nitrodur – patch
    - Nitro-Bid – ointment

# Antianginal Agents

## Nitrates/Nitrites (cont.)

- Indications
  - Acute relief of angina
  - Prophylaxis in situations that may provoke angina
  - Long-term prophylaxis of angina
- Side effects
  - Headache
    - Usually diminish in intensity and frequency with continued use
  - Tachycardia, postural hypotension
  - Tolerance may develop

# Antianginal Agents

## Beta-Blockers

- Examples
  - atenolol (Tenormin)
  - metoprolol (Lopressor)
  - propranolol (Inderal)
  - nadolol (Corgard)

# Antianginal Agents

## Beta-Blockers (cont.)

### Mechanism of action

- Decreases HR
  - Results in
    - Decreased myocardial oxygen demand
    - Increased oxygen delivery to the heart
- Decrease myocardial contractility
  - Decreases demand & conserves energy

# Antianginal Agents

## Beta-Blockers (cont.)

### Indications

- Angina
- Antihypertensive
- Cardioprotective effects,
  - Especially after MI
- Some used for migraine headaches

# Antianginal Agents

## Beta-Blockers (cont.)

### Side effects

#### Body System

#### Effects

Cardiovascular

Bradycardia, hypotension  
second- or third-degree heart  
block; heart failure

Metabolic

Altered glucose and lipid  
metabolism

# Antianginal Agents

## Beta-Blockers (cont.)

### Side effects (cont'd)

<u>Body System</u>	<u>Effects</u>
CNS	Dizziness, fatigue, mental depression, lethargy, drowsiness, unusual dreams
Other	Impotence, wheezing, dyspnea

# Antianginal Agents

## Calcium Channel Blockers

- Examples
  - verapamil (Calan)
  - diltiazem (Cardizem)
  - nifedipine (Procardia)

# Antianginal Agents

## Calcium Channel Blockers (cont'd)

### Mechanism of action

- Cause peripheral arterial vasodilation
- Reduce myocardial contractility  
(negative inotropic action)
- Result: decreased myocardial oxygen demand

# Antianginal Agents

## Calcium Channel Blockers (cont'd)

### Indications

- First-line agents for treatment of angina, hypertension, and supraventricular tachycardia
- Short-term management of atrial fibrillation and flutter
- Several other uses

# Antianginal Agents

## Calcium Channel Blockers (cont'd)

### Side effects

- Very acceptable side effect and safety profile
- May cause hypotension, palpitations, tachycardia or bradycardia, constipation, nausea, dyspnea

# Antianginal Agents

## Nursing Implications (cont'd)

- Before administering, perform a complete health history to determine presence of conditions that may be contraindications for use or call for cautious use
- Obtain baseline VS, including respiratory patterns and rate
- Assess for drug interactions

# Antianginal Agents

## Nursing Implications (cont'd)

- Patients should not take any medications, including OTC medications, without checking with the physician
- Patients should report blurred vision, persistent headache, dry mouth, dizziness, edema, fainting episodes, weight gain of 2 pounds in 1 day or 5 or more pounds in 1 week, pulse rates less than 60, and any dyspnea

# Antianginal Agents

## Nursing Implications (cont'd)

- Alcohol consumption and hot baths or spending time in whirlpools, hot tubs, or saunas will result in vasodilation, hypotension, and the possibility of fainting
- Teach patients to change positions slowly to avoid postural BP changes
- Encourage patients to keep a record of their anginal attacks, including precipitating factors, number of pills taken, and therapeutic effects

# Antianginal Agents

## Nursing Implications (cont'd)

### Nitroglycerin:

- Instruct patients in proper technique and guidelines for taking sublingual NTG for anginal pain
  - Every 5 minutes up to 3 SL tablets/sprays until pain relieved
    - No pain relief – CALL 911 – DO NOT DRIVE
- Instruct patients never to chew or swallow the SL form
- Instruct patients that a burning sensation felt with SL forms indicates that the drug is still potent
- Instruct to lie down and move slowly

# Antianginal Agents

## Nursing Implications (cont'd)

### Nitroglycerin (cont'd)

- Instruct patients to keep a fresh supply of NTG on hand; potency is lost in about 3 months after the bottle has been opened
- Medications should be stored in an airtight, dark glass bottle with a metal cap and no cotton filler to preserve potency
- Tobacco use can reduce the effectiveness of nitrates

# Antianginal Agents

## Nursing Implications (cont'd)

### Nitroglycerin (cont'd)

- Instruct patients in the proper application of nitrate topical ointments and transdermal forms, including site rotation and removal of old medication
  - Nurse needs to take care not to touch ointment
    - Can absorb and cause hypotension/syncope
- To reduce tolerance, the patient may be instructed to remove topical forms at bedtime, and apply new doses in the morning, allowing for a nitrate-free period

# Antianginal Agents

## Nursing Implications (cont'd)

### Nitroglycerin (cont'd)

- Instruct patients to take prn nitrates at the first hint of anginal pain
- If experiencing chest pain, the patient taking SL NTG should be lying down to prevent or decrease dizziness and fainting that may occur due to hypotension
- Monitor VS frequently during acute exacerbations of angina and during IV administration

# Antianginal Agents

## Nursing Implications (cont'd)

### Nitroglycerin (cont'd)

- IV forms of NTG must be contained in glass IV bottles and must be given with infusion pumps
- Discard parenteral solution that is blue, green, or dark red
- Follow specific manufacturer's instructions for IV administration; use special IV tubing provided or non-PVC tubing

# Antianginal Agents

## Nursing Implications (cont'd)

### Calcium Channel Blockers

- Blood levels should be monitored to ensure they are therapeutic
- Oral CCBs should be taken before meals and as ordered
- Patients should be encouraged to limit caffeine intake
- Coverings of the drug can be expelled in the bowel movement – esp verapamil (Calan)
  - Tell patients that drug is still being absorbed

# Antianginal Agents

## Nursing Implications (cont'd)

### Beta-Blockers

- Patients taking beta-blockers should monitor pulse rate daily and report any rate lower than 60 beats per minute
- Dizziness or fainting should also be reported
- Constipation is a common problem
  - Instruct patients to take in adequate fluids and eat high-fiber foods

# Antianginal Agents

## Nursing Implications (cont'd)

### Beta-Blockers (cont.)

- These medications should never be abruptly discontinued due to risk of rebound hypertensive crisis
  - SE of impotence
    - Commonly cause immediate noncompliance
    - Teach - NOT TO STOP IMMEDIATELY
- Inform patients that these medications are for long-term prevention of angina, not for immediate relief

# Antianginal Agents

## Nursing Implications (cont'd)

- Monitor for adverse reactions
  - Allergic reactions, headache, lightheadedness, hypotension, dizziness
- Monitor for therapeutic effects
  - Relief of angina, decreased BP, or both