Pharmacology Refresher for Home Health Therapists & Nurses

Session 2:
Cardiovascular and Pulmonary Medications

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Learning Objectives

- At the end of this presentation the student should be able to:

1. Given a patient case, identify medications that act on the cardiovascular or respiratory systems and classify them by mechanism in order to predict therapeutic and adverse effects.
2. Identify basic therapeutic effects and common adverse effects for the medications that act on the cardiovascular and respiratory systems.
3. Identify therapeutic and toxic effects of medications used for the treatment of cough and cold
4. Describe anticholinergic adverse effects.

Targets for CV Medications

- Adrenergic Receptors
- Calcium Channel Receptors
- Renin-Angiotensin-Aldosterone System
- Renal excretion of Na+ and water
- Vasodilation via nitric oxide
- Coagulation Cascade
- Cholesterol Synthesis and Absorption

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Adrenergic Receptors

- Three types:
  - α_1 and α_2
  - β_1 and β_2
  - Dopamine (D)
- Effects vary by receptor type and location.
- CV Effects:
  - α_1 - smooth muscle contraction, vasoconstriction
  - α_2 – central stimulation inhibits sympathetic tone
  - β_1 – increased heart rate, contractility and conduction
  - β_2 – bronchodilation

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Sympathomimetics

- Use for treatment of:
  - Shock
  - Anaphylaxis
  - Hypotension
  - Asthma
  - Nasal Congestion
- Adverse Effects
  - Extensions of pharmacologic action
  - BP, HR, skeletal muscle tremor, arrhythmia

Example Agents:

Epinephrine
Norepinephrine
Dopamine

Phenylephrine
Pseudoephedrine

Midodrine

Albuterol
Salmeterol

Alpha 1 Antagonists

- Block alpha receptors in periphery
- Use for treatment of:
  - Hypertension
  - Benign Prostatic Hypertrophy
- Adverse Effects
  - 1st dose syncope
  - Orthostatic hypotension

Example Agents

- Doxazosin (Cardura)
- Prazosin (Minipress)
- Terazosin (Hytrin)
- Tamsulosin (Flomax)

Note 'zosin' ending

Beta-Antagonists "Beta-Blockers"

- Clinical effects
  - Lowers resting heart rate
  - Lowers blood pressure
  - Controls heart rhythm
- Adverse Effects:
  - Hypotension
  - Bradycardia
  - Heart failure
  - Bronchospasm possible
  - Decreased exercise tolerance
  - Blunted HR and BP response to exercise
  - Rebound tachycardia with abrupt d/c

Example Agents:
- Propranolol (Inderal)
- Carvedilol (Coreg)
- Atenolol (Tenormin)
- Metoprolol (Toprol XL, Lopressor)
- Nebivolol (Bystolic)

- Note 'ol' ending

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Calcium Channel Antagonists or "Blockers"

- Block contraction leading to vasodilation
- Also inhibit HR and reduce contractile force
- Adverse effects:
  - Hypotension
  - Bradycardia
  - Peripheral edema

Example CCBs:
- More likely to cause peripheral edema
  - Amlodipine (Norvasc)
  - Nifedipine (Procardia)
- More likely to affect heart rate:
  - Diltiazem
  - Verapamil

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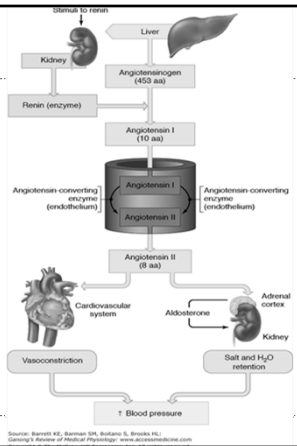
Renin Angiotensin System



From: Chapter 38. Regulation of Extracellular Fluid Composition & Volume. In: Barrett KE, Boitano S, Barman SM, Brooks HL, eds. *Ganong's Review of Medical Physiology, 24e*. New York: McGraw-Hill; 2012.http://accesspharmacy.mhmedical.com/content.aspx?bookid=393&Sectionid=39736788. Accessed February 18, 2014.

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Drugs that act on the angiotensin system: Angiotensin Converting Enzyme Inhibitors

- Inhibits conversion of AT I to AT II
  - Lowers BP
  - Renal protective
- Adverse Effects:
  - Hypotension
  - Cough
  - Hyperkalemia
  - Acute renal failure
  - Angioedema

Example ACE Inhibitors:
- Lisinopril (Zestril)
- Enalapril (Vasotec)
- Captopril (Capoten)
- Ramipril (Altace)
- Quinapril (Accupril)
  - → Note 'pril' ending

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Drugs that act on the angiotensin system: Angiotensin Receptor Blockers (ARBs)

- Binds to receptor to inhibit effects of ATII
- Adverse Effects:
  - Hypotension
  - Less cough
  - Hyperkalemia
  - Acute renal failure
  - Less angioedema

Example ARBs:
- Losartan (Cozaar)
- Irbesartan (Avapro)
- Olmesartan (Benicar)
- Telmisartan (Micardis)
- Valsartan (Diovan)
  - → Note 'sartan' ending

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Drugs that act on the angiotensin system: Direct Renin Inhibitors

- Inhibits renin mediated conversion of Angiotensinogen to AT I
- Adverse Effects:
  - Generally well tolerated, less risk of cough or angioedema
  - GI sx, rash, increased BUN, SCr possible

Approved Agent:
Aliskiren (Tekturna)

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Diuretics

- Facilitate loss of water and electrolytes through urine
  - Lowers blood pressure
  - Treats edema
- Act in:
  - Distal tubule of nephron or
  - Loop of Henle
- Adverse effects:
  - Loss of electrolytes
    - K^+, Na^+
  - Orthostatic Hypotension
  - Reflex tachycardia
  - Dehydration

Example Diuretics

Thiazide diuretics:
- Hydrochlorothiazide
- Chlorothiazide
- Metolazone

Loop diuretics
- Furosemide
- Bumetanide

Potassium-sparing:
- Spironolactone
- Triamterene

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Nitric Oxide Mediated Vasodilation

- Several preparations are sources of nitric oxide (NO)
- NO interacts with a receptors to cause vascular smooth muscle relaxation and vasodilation
- Effect is dose related
- Adverse effects:
  - Nitrate tolerance
  - Headache, dizziness
  - CV effects, syncope

Example preparations:
- Nitroglycerin
- Isosorbide Dinitrate
- Isosorbide Mononitrate

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Impact on Patient Care

- Drugs used for broad spectrum of CV conditions
- Monitoring should target BP, HR, postural hypotension, presence of bronchoconstriction
- Avoid use of HR (Beta blockers only) to judge exertion
- Assist patients to avoid syncope

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Anticoagulants

- Used to treat or prevent thrombosis (e.g., DVT post orthopedic surgery)
- Primary adverse effect is increased bleeding risk:
  - Major (e.g., critical site bleeding such as intracranial, pericardial, intramuscular, etc)
  - Minor (e.g., bruising, gum bleed)
- Many need frequent monitoring:
  - Coumadin: INR
  - IV Heparin: Prothrombin Time (PTT)

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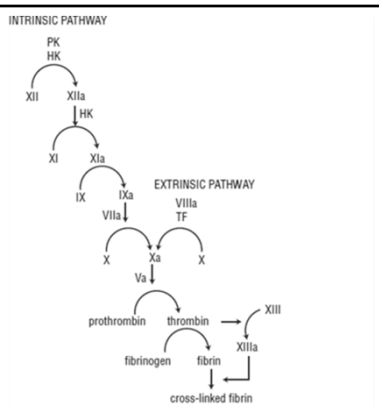
Example Anticoagulants:

- Heparin
- Low Molecular Weight Heparins
  - Enoxaparin (Lovenox)
  - Daltaparin (Fragmin)
  - Tinzaparin (Innohep)
- Direct Thrombin Inhibitors
  - Argatroban
  - Bivalrudin (Angiomax)
  - Dabigatran (Pradaxa)
  - Lepirudin (Refludan)
- Anti-factor Xa inhibitors
  - Fondaparinux (Arixtra)
  - Rivaroxaban (Xarelto)
  - Apixaban (Eliquis)
- Vitamin K Antagonists
  - Warfarin (Coumadin)



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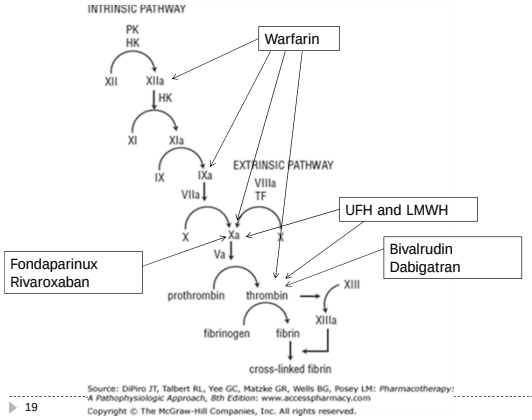

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Anti-platelet Agents

- Inhibit platelet aggregation via prostaglandin and thromboxane or by ADP receptor
- Used to prevent formation of athlerosclerotic arterial clots
- Adverse effect
  - Increase risk of bleeding
  - GI irritation / distress

Example Agents:
- Aspirin
- Clopidogrel (Plavix)
- Ticlopidine (Ticlid)
- Dipyridamole / Aspirin (Aggrenox)

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Inhibitors of Cholesterol Synthesis

- Inhibits HMG CoA, enzyme responsible for cholesterol synthesis
- Well tolerated, risk of:
  - Liver damage
  - Skeletal muscle toxicity:
    - Myopathy
    - Rhabdomyolisis with acute renal failure

Example Statins:
- Atorvastatin (Lipitor)
- Simvastatin (Zocor)
- Pravastatin (Pravachol)
- Rosuvastatin (Crestor)

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Impact on Patient Care

- Anticoagulants often used in patients on prolonged bedrest or post-ortho surgery
- Primary concern is bleeding risk
- Use caution with rigorous manual techniques to avoid tissue trauma
- Support adherence to meds and lifestyle changes in patients on chronic CV medications

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Medications Used for Pulmonary Disease

- Generally inhaled medications are used when possible for treatment of respiratory disease.
- Less systemic exposure, much less risk of adverse reactions.
- If needed, systemic medications may also be used.

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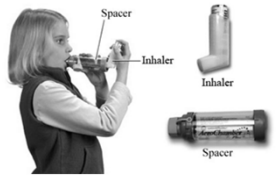
Inhalation Devices



Accessed at: http://www.webmd.com/asthma/spacer-for-metered-dose-inhalers-mdis

Accessed at: http://asthmasymptoms.net/nebulizer-for-asthma.html

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Accessed at: http://www.consortmedical.com/Bespak

Inhaled Medications

- Inhaled corticosteroids
  - Anti-inflammatory
  - May cause throat / voice discomfort
  - Very high doses may increase risk of osteoporosis
- Use chronically

Example Agents
- Fluticasone (Flovent)
- Triamcinolone (Azmacort)
- Betamethasone (QVAR)
- Flunisolide (Aerobid)
- Mometasone (Asmanex)
- Budesonide (Pulmicort)

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Inhaled Medications

- Inhaled $Beta_2$ Agonists
  - Bronchodilators
  - Adverse effects: palpitations, tremor
  - Use as needed for "rescue" from symptoms
  - Long acting agents used to prevent symptoms or for daily control

Rescue Agents
- Albuterol (Proventil, Ventolin)
- Levalbuterol (Xopenex)

Long Acting Agents
- Salmeterol (Serevent)
- Formoterol (Foradil)
- Indacaterol (Arcapta)

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Inhaled Medications

- Inhaled Anticholinergics
  - Bronchodilators
  - Very well tolerated, few adverse reactions

Example Agents
- Ipratropium (Atrovent)
- Tiotropium (Spiriva)
- Aclidinium (Tudorza)

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Combination Inhalers

- Inhaled Corticosteroids + LABA
  - Advair (fluticasone + salmeterol)
  - Symbicort (budesonide + fomoterol)
  - Dulera (momatesone + fomoterol)
  - Breo (fluticasone + vilanterol)
- Short Acting Beta Agonist + cholinergic
  - Combivent (albuterol + ipratropium)
  - DuoNeb (albuterol + ipratropium) – nebulizer vials

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Other Respiratory Medications

- Theophylline / Aminophylline
  - Adverse effects limit use
    - CNS stimulation
    - CV stimulation
    - possible seizures at high doses.
- Leukotriene Inhibitors
  - Montelukast (Singulair)
- Systemic Glucocorticoids

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Other Respiratory Medications- Allergy and Cough/ Cold Remedies

- Antihistamines
  - Can improve histamine-related symptoms: itching, runny nose, sneezing
  - ADRs: Anticholinergic effects, sedation
- Decongestants – psuedoephedrine, phenylephrine
  - Can improve stuffy nose, congestion, post nasal drip
  - ADRs: CV stimulation, increased BP
- Cough Suppressants – dextromethorphan, codeine
  - Use as needed to increase threshold to trigger a cough
  - ADRs: GI upset, sedation
- Expectorant - guaifenesin
  - Use as needed to facilitate 'coughing up' of secretions
  - Well tolerated, possible GI upset.

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Impact on Patient Care

- Drugs used to manage respiratory secretions
- May be used in conjunction with postural interventions to promote drainage and improve breathing
- May need to coordinate physical and occupational therapy with respiratory therapy
- Monitor and support patients prone to acute respiratory attacks
- Encourage use of rescue inhalers as needed (or in preventative manner when appropriate)

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Patient Case

You are attending a home visit to an 83 year old man
PMH: major depression, type 2 diabetes mellitus, high blood pressure, high cholesterol, and chronic lung disease from many years of cigarette smoking.

Medication List:
- Metformin
- Glyburide
- Aspirin
- Lisinopril
- Atenolol
- Crestor
- Celexa
- Albuterol Inhaler
- Advair Inhaler

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Questions?

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