Final Exam Pharmacology Review

Chapter 13

Parasympatholytics- Anticholinergic, cholinergic antagonist blocker

Rest & Digest
Actions of drugs in that class:
- **constricts pupils** (cranial nerves)
- **stimulates salivation** (Cranial nerves)
- **slows heart** (Cranial nerves)
- **constricts bronchioles** (Cranial Nerves)
- **stimulates digestion** (Cranial Nerves)
- **stimulates gallbladder** (Cranial Nerves)
- **contracts bladder** (Sacral Nerves)
- **stimulates sex organs** (Sacral Nerves)

Side Effects- dry mouth, urinary ret, tachycardia, blurred vision, Resp. failure/ high dose

Sympathomimetics- Adrenergic, adrenergic agonists

Fight or Flight
Actions of drugs in that class:
- **dilates pupils** (Thoracic Nerves)
- **inhibits salivation** (Thoracic Nerves)
- **accelerates heart** (Thoracic Nerves)
- **dilates bronchioles** (Thoracic Nerves)
- **inhibits digestion** (Thoracic Nerves)
- **stimulates release of glucose** (Thoracic Nerves)
- **secretes epinephrine and norepinephrine** (lumbar nerves)
- **relaxes bladder** (lumbar nerves)
- **inhibits sex organs** (Lumbar nerves)

Side Effects- **Tachycardia, hypertension**

Name some- **Dopamine, norepinephrine, epinephrine**

**Sympahtolytics- adrenergic antagonist, blocker (alpha 1,2) (Beta 1, 2)**
Actions- constricts pupils, lowers HR, and BP, stimulates digestion, urinary retention, vasodilation. (Opposite of Fight or Flight)

Side Effects- bradycardia, hypotension, wheezing, migrains, heart failure

Name Some- atenolol, propanolol, metropolol

Parasympathomimetics—cholinergic, sympatholytic, ACHE, adrenergic antagonist
Produce Rest & Digest characteristics.
Action- constricts pupils, stimulate saliva, constrict airway, promote erection of genitals

Side Effects—lowers BP, lowers pulse, lowers resp, stimulates smooth muscle and gland secretion.

Name some- Acebutolol, alfuzonin, aternolol, carteolol, esmolol, nadolol

Chapter 14

Anxiolytics: Drugs that have the ability to relieve anxiety.
   Ex: CNS depressants, Anti-depressants, anti-seizure drugs, mood disorder drugs, antihypertensive drugs, and antidysrhythmic drugs.

Insomnia Medications: Benzodiazepines, Barbiturates, hypnotics, tranquilizer.

Antidepressants- To treat depression or depression that accompanied anxiety. Also treat anxiety today.
   Tricyclic Antidepressants (P.O)- Not recommended in patients with a history of heart attack, heart block, or arrhythmia.
      Adverse: dry mouth, blurred vision, urine retention, and hypertension.
      -Avoid pregnancy, alcohol, if have GI disorders, schizophrenia, or bipolar disorder
   Selective Serotonin Reuptake Inhibitors (SSRIs)(P.O)- Safest class of antidepressants.
      Less common sympathomimetic effects, few anticholingeric effects.
      -Can cause weight gain and sexual dysfunction

Monoamine Oxidase Inhibitors (MAOIs)(P.O)- Patients must strictly avoid foods containing tyramine. Avoid caffeine intake to avoid a hypertensive crisis.
   -MAOIs potentiate effects of insulin and other diabetic drugs.
      Adverse: orthostatic hypotension, headache, diarrhea.
   -MAOIs are rarely used because potential for serious adverse effects.
**Benzodiazepines:** Most widely prescribed drug class. Most preferred for anxiety and insomnia.

- Intensify the effect of GABA, which is a natural inhibitory neurotransmitter found throughout the brain. They do NOT produce life threatening respiratory depression or coma if taken in excessive amounts. Death is unlikely.

  **Diazepam (Valium) and Lorazepam (Ativan)**- parenterally.
  Adverse: Drowsiness, sedation, lethargy, ataxia.

**Barbiturates**- Used to be drug of choice for anxiety and insomnia before benzodiazepines were discovered.

- **High risk for psychological and physical dependence.**
- **Extremely fatal withdrawal symptoms.**
- **Depress CNS**

**At low doses**- reduce anxiety and cause drowsiness
**Moderate doses**- inhibit seizure activity
**Higher doses**- can induce anesthesia

Chapter 15

**GABA drugs (Gamma-Aminobutyric Acid)**- Primary neurotransmitter in the brain. These drugs **MIMIC the effects of GABA** by stimulating an influx of chloride ions that interact with the GABA receptor.

- When the receptor is stimulated, chloride ions move into cell and suppress the firing of neurons.

  **Barbiturates:** Intensify effect of GABA in brain and depress the firing of CNS neurons.

  **Benzodiazepines:** Intensify effect of GABA in brain.

**Hydantoins:** Dampen CNS activity by delaying an influx of sodium ions across neuronal membranes. These drugs **treat seizures**.

- Sodium channels are not blocked, just desensitized.
- If channels are blocked, neuronal activity completely stops, like local anesthetics.
  Useful for treating all types of epilepsy except absence seizures.

  **Very narrow range between therapeutic dose and a toxic dose. Patients must be carefully monitored.**

**Succinimides:** Medications that **suppress seizures by delaying calcium influx into neurons.**

- **Preferred choice for absence seizures.**

**Amino Acid Compounds:** Reduce brain excitability by suppressing positive ion influxes in a manner differently from other seizure meds. May suppress ischemia-associated glutamate release.
-potential allergic reactions, dizziness, irregular heartbeat, and coordination problems.

Chapter 16

**Drugs for Bipolar Disorder:** Sometimes called mood stabilizers.

- **Lithium (Eskalith)** - traditional treatment of bipolar disorder, in combo with other drugs (anti-seizure drugs)
  - Narrow therapeutic range, monitored via serum levels every 1-3 days when beginning therapy, and every 2-3 months thereafter.
  - 0.6-1.5 mEq/L is therapeutic range.
  - Lithium acts like sodium in the body so conditions which sodium is loss (excessive sweating or dehydration, can cause LITHIUM TOXICITY

**Attention Deficit/Hyperactivity Disorder Drugs:** CNS stimulants.

- Stimulate specific areas of CNS that heighten alertness and increase focus.
  - Adverse: insomnia, nervousness, anorexia, and weight loss.

Chapter 17

**Phenothiazines:** Most effective at treating the positive signs of schizophrenia, such as hallucinations and delusions, has been treatment of choice for psychoses for 60 years.

- Hallucinations and delusions often begin to diminish within days.
- Other symptoms may require as long as 7-8 weeks of pharmacotherapy to improve.

**Usually administered long term, usually for life.**

Act by preventing dopamine and serotonin from occupying critical neurologic receptor sites.

- **Adverse:** Anticholinergic effects, dry mouth, postural hypotension, urinary retention.
  - Ejaculation disorders occur in high % of patients.
  - Delay in orgasm in both men and women, common cause for noncompliance
  - Menstrual disorders are high.
  - High fever, tachycardia, incontinence, confusion, and the signs of neuroleptic malignant syndrome (NMS)

**Antipsychotic drugs do not cause physical or psychological dependence. They also have a wide safety margin between therapeutic and lethal dose.
- Deaths due to OD of antipsychotic drugs are uncommon.

**Extrapyramidal Side Effects** - serious set of adverse effects related to antipsychotic drugs.

- Acute dystonia - severe muscle spasms, in back, neck, tongue, face.
- Akathisia - inability to rest or relax.
- Parakinsonism - tremor, muscle rigidity, stooped posture, shuffling gait.
- Tardive dyskinesia - lip smacking and wormlike motions of tongue.
Nonphenothiazines: Have efficacy equal to phenothiazines. Less sedation and anticholinergic adverse effects. Extrapyramidal effects may be common, particularly in older adults. Same therapeutic effects and efficacy as phenothiazines. Block postsynaptic D2 dopamine receptors. They offer no significant advantages over the phenothiazines in treatment of schizophrenia.

Dopamine Stabilizers: Treatment of schizophrenia and schizoaffective disorder
- Less extrapyramidal symptoms than haloperidol and fewer weight gain issues
- Virtually non existant anticholinergic effects.
  Adverse: headache, nausea/vomiting, fever, constipation, and anxiety.

Chapter 18

Opioid Analgesics: Natural or synthetic morphine like substance responsible for reducing moderate to severe pain. Narcotic substances, produce numbness or stupor-like symptoms

Opioid Agonist: Bind to opioid receptors and produce multiple responses throughout the body. Like morphine.
- First line of drug for moderate to severe pain
- Suppress cough reflex and slowing motility of GI tract for cases of severe diarrhea.

Opioid Antagonist: Substances that prevent the effects of opioid agonist.

NonSteroidal Anti-Inflammatory Drugs (NSAIDS)- Inhibiting pain mediators at the nociceptor level. NSAIDs inhibit cyclooxygenase, an enzyme responsible for the formation of prostaglandins.
  - When cyclooxygenase is inhibited, inflammation and pain are reduced.
  - Drug of choice for mild to moderate pain, especially pain from inflammation

Aspirin, Ibuprofen, and COX-2 Inhibitors
- Aspirin and Ibuprofen inhibit COX-1 and COX-2
  Celebrex is the representative COX-2 Inhibitor.

Aspirin has a greater effect on blood coagulation than ibuprofen; thus aspirin is used for prophylaxis of cardiovascular events but ibuprofen is not.
- Aspirin poses a greater risk for GI bleeding.
- Platelet aggregation inhibition caused by aspirin is irreversible, should be discontinued 1 week prior to elective surgery.
- Should not be taken with warfarin or heparin.

Anti-Migraine Medications: Stop migraines in process and prevent migraines are the two primary goals.
- Migraine termination generally begins with acetaminophen or NSAIDs.
- If these do not work, Triptans (Sumatriptan/Imitrex) are usually the drug of choice.
-PO most convenient, if patient is nauseas and vomiting, alternate dose route available. 
- Intranasal formulations and profiled syringes of triptans are available for patients who are able to self administer the medication.
   Side Effects- Asthenia, tingling, warming sensation, dizziness, vertigo, Coronary artery vasospasm, MI, cardiac arrest.

If Triptans do not work, Ergot Alkaloids may be used to abort migraines. 
- Available in oral, sublingual, and suppository forms.
  Side Effects: weakness, nausea, vomiting, abnormal pulse, pruritus.
  Delirium, convulsive seizures, intermittent claudication.

**Drugs for Migraine prophylaxis include:** Anti-seizure drugs, beta adrenergic blockers, calcium channel blockers, antidepressants, and neuromuscular blockers.

- These drugs are used only if patient is unresponsive to the drugs used to abort migraines.
  - Propranolol (Inderal) - most commonly prescribed.

**Chapter 19**

**General Anesthesia:** Loss of sensation throughout the entire body, accompanied by loss of consciousness. Used for patients who need to remain still and without pain for a longer time than can be achieved with local anesthetics.
  - Rarely achieved with a single drug.

**IV drugs are usually administered first because they work within seconds.**

**After patient loses consciousness, inhaled drugs may be used to maintain the anesthesia.**

**Nitrous Oxide (Laughing gas)**- used for brief obstetric and surgical procedures and for dental procedures.
  - Use cautiously in patients with myasthenia gravis, because it may cause respiratory depression and prolonged hypnotic effects.

**Volatile Liquids:** liquid at room temperature but are converted into a vapor and inhaled to produce their anesthetic effects.
  - Enlurane (Ethrane) and Isoflurane (Forane)
  - Most volatile liquids depress cardiovascular and respiratory function. Because it has less effect on the heart and does not damage the liver, Isoflurane (Forane) is one of the widely used inhalation anesthetics.
**IV General Anesthetics:** Often administered with inhaled general anesthetics. Concurrent administration of IV and inhaled anesthesia allows the dose of inhaled anesthesia to be reduced, lowering the potential for serious adverse effects.
- Combined IV and Inhaled anesthesia provide greater analgesia and muscle relaxation than could be provided by the inhaled anesthetic alone.
- IV alone is generally reserved for medical procedures that take less than 15 minutes.

**Anesthesia Adjuncts:** Used either to complement the effects of general anesthetics or to treat anticipated side effects of anesthesia. *May be given Prior to, during, or after surgery.*

*Preoperative drugs are given to relieve anxiety and to provide mild sedation.*

*Opioids such as morphine may be given to counteract pain that the patient will experience after surgery.*

*Anticholinergics such as atropine may be administered to dry secretions and to suppress the bradycardia caused by some anesthetics.*

*Sedative-hypnotic drugs help reduce fear, anxiety, or pain associated with the surgery.*

During surgery, the primary adjuncts are the **Neuromuscular blockers.**
- Neuromuscular blockers cause paralysis without loss of consciousness, which means that without general anesthetic, patients would be awake without the ability to move.
  - *Breathing muscles are skeletal, so patients have to be intubated and require mechanical ventilation.*
  - *Should be discontinued after surgery as soon as it is clinically possible.*

**Chapter 22**

**Statins (HMG-CoA reductase inhibitors)**- Can produce a dramatic 20%-40% reduction in LDL cholesterol levels. In addition to dropping LDL levels, statins can lower triglyceride and VLDL levels, and raise HDL.

**HMG-CoA Reductase**- serves as *primary regulatory site for cholesterol biosynthesis.*
- Under *normal conditions,* this enzyme is *controlled through negative feedback.* High levels of LDL in blood will shut down production of HMG-CoA reductase, thus **turning off the cholesterol pathway.**
- Statins inhibit HMG-CoA reductase which results in less cholesterol biosynthesis.
- Patients remain on drug for remainder of life or until hyperlipidemia can be controlled through dietary or lifestyle changes.
- **All Statins give Orally.**

  **Adverse:** *Headache, fatigue, muscle or joint pain, heartburn.*
  *Rare but serious: Severe myopathy and Rhabdomyolysis,* breakdown of muscle fibers, usually due to muscle trauma or ischemia.
- Because cholesterol biosynthesis in the liver is higher at night, statins with short half-lives (Lovastatin) should be administered in the evening.
- Longer half-life statins are effective regardless time of day they are taken.
- **All contraindicated in patients who are pregnant.**
**Bile Acid Sequestrants:** Bind to bile acids, thus increasing excretion of cholesterol in the stool. Excreted in the feces. Liver responds to loss of cholesterol by making more LDL receptors, which removes even more cholesterol from the blood. 

Adverse: Bloating and constipation.

**Fibric Acid Agents:** for patients with excessive Triglyceride and VLDL levels. Drug of choice for treating severe hypertriglyceridemia. Better used in combination with a statin.

**Chapter 23**

**Diuretic:** drug that increases the rate of urine flow. Goal of most diuretic therapy is to reverse abnormal fluid retention by the body. 

- Most common mechanism is by blocking sodium(NA+) reabsorption in the nephron, sending more NA+ to the urine. Chloride Ions (CL-) follow sodium.

**Loop Diuretics:** Most effective diuretic. **Block reabsorption of NA+ and Cl- in loop of Henle.** 

- When given IV, have ability to cause large amounts of fluid to be excreted by the kidney in a very short time.
- Loop diuretics used to reduce edema associated with heart failure, hepatic cirrhosis, or chronic renal failure.
- **Furosemide (Lasix)** is most frequently prescribed loop diuretic. 
  - Able to increase urine output even when blood flow to kidneys is diminished.
  - Valued in patients with renal failure.

Adverse: Dehydration and electrolyte imbalance: thirst, dry mouth, weight loss and headache.

*Potassium depletion can be serious and cause dysrhythmias, potassium supplements may be prescribed to prevent hypokalemia.*

Because of potential for serious side effects, loop diuretics are normally reserved for patients with moderate to severe fluid retention, or when other diuretics have failed to work. Can be ototoxic so avoid aminoglycosides or other ototoxic drugs.

**Thiazide Diuretics:** Largest most frequent prescribed class of diuretics.

- Act on **distal tubule to block NA+ reabsorption and increase K+ and water excretion.**
- Ineffective in patients with severe renal failure.

Adverse: Dehydration and excessive loss of NA+ K+ or Cl- may occur. Potassium supplements may be indicated during thiazide therapy to prevent hypokalemia. Patients with diabetes should be aware that thiazides sometimes raise blood glucose levels.

**Potassium Sparing Diuretics:** Does not affect blood K+ levels. Blocking NA+, retaining K+ Primary Use: used in combo with thiazide or loop diuretics to minimize potassium loss. 

**Spironolactone:** Acts by blocking the actions of hormon aldosterone. 

- **Blocking Aldosterone** enhances the excretion of NA+ and retention of K+.
Patients taking potassium sparing diuretics should take potassium supplements or be advised to not add potassium rich foods to their diets.

- Excess K+ when taking this medication may lead to hyperkalemia.

Osmotic Diuretics:

**Mannitol**- used to maintain urine flow in patients with acute renal failure or during prolonged surgery.

- Not reabsorbed in the tubule.
- Can be used to lower intraocular pressure in certain types of glaucoma.
  
  - Highly potent diuretic given ONLY IV.
  
  - Mannitol can worsen edema and must be used with caution in patients with pre-existing heart failure or pulmonary edema.
  
  - EXCEPTION: mannitol an urea can reduce intracranial pressure due to cerebral edema.

- Osmotic diuretics are rarely drugs of first choice due to their potential toxicity.

Chapter 24

**IV Fluids**: used to maintain blood volume and support blood pressure.

**IV Therapy with Crystalloids**: Contain electrolytes, and other substances that closely mimic the body’s ECF. Used to replace depleted fluids and to promote urine output.

- Quickly diffusing across membranes, leaving the plasma and entering the interstitial fluid and ICF.
  
  - Sodium is most common crystalloid added to solutions
  
  - Infusion of crystalloids will increase total fluid volume in the body.

Isotonic Crystalloids (Normal Saline)- often used to treat fluid loss due to vomiting, diarrhea, or surgical procedure, especially when blood pressure is low.

Hypertonic Crystalloids- Relieves cellular edema, especially cerebral edema.

Hypotonic Crystalloids- will cause water to move out of the plasma to the tissues and cells in the intracellular compartment. For patients with hypernatremia and cellular dehydration.

*Patients who are dehydrated with low blood pressure should be given NORMAL SALINE.*

*Patients who are dehydrated with NORMAL blood pressure should be given HYPOTONIC.*

**Colloids**: Proteins, starches, or other large molecules that remain in the blood for a long time because they are too large to easily cross the capillary membranes.

- Treating hypovolemic shock due to burns, hemorrhage, or surgery.
Most commonly used colloid is normal serum albumin

Electrolytes: small charged molecules essential to homeostasis. Too little or too much of an electrolyte can result in serious complications and must be quickly corrected.

Positive charged ions are called Cations.
Negative charged ions are called Anions.

Hypernatremia- Serum sodium level rises above 145 mEq/L

Buffers: Chemicals that help maintain normal body pH by neutralizing strong acids and bases.

2 primary buffers in the body are Bicarbonate ions and Phosphate ions.

Co2 excreted by lungs during exhalation.

Kidneys remove excess acid in form of hydrogen ion by excreting it in urine.

Acidosis: Excess acid, when pH falls below 7.35
-Infusion of Sodium Bicarbonate quickly neutralize acids in blood.

Alkalosis: Excess base, when pH rises above 7.45
-May administer NaCl concurrently with potassium chloride.

Chapter 25

Angiotensin-Converting Enzyme (ACE)- Converts Angiotensin 1 to angiotensin 2.

ACE Inhibitors “Give them an ACE and they'll cough in your face”
-Block the effects of angiotensin II, decreasing blood pressure through two mechanisms:
  -Lowering peripheral resistance
  -Decreasing blood volume.

ACE inhibitors enhance the effects of Thiazide Diuretics, used concurrently in management of hypertension.

Adverse: persistent cough and postural hypotension.
-Cough caused by accumulation of bradykinin, a proinflammatory substance.
-Hyperkalemia can occur.

Although rare, Angioedema can develop. Swelling around lips, eyes, throat, and other body regions.

Adrenergic Blockers (Alpha Blockers): Directly block adrenergic receptors. These actions are either specific to alpha or beta. Relaxes smooth muscle in small arteries, alpha1 blockers such as doxazosin (Cardura) cause vasodilation, DECREASING blood pressure. Also treats BPH due to ability to increase urine flow by relaxing smooth muscle in the blader neck, prostate, and urethra..
Most Common Side effect: Orthostatic Hypertension

**Alpha 2 Agonist:** Decrease the outflow of sympathetic nerve impulses from the central nervous system to the heart and arterioles.
- Slowing HR and conduction velocity and dilation of the arterioles.
- Can cause sedation, dizziness, and other CNS effects.

**Direct Vasodilators:** Cause a DIRECT relaxation of vascular smooth muscle.
Can cause reflex tachycardia, forcing the heart to work harder, and BP increases, counteracting the effect of the antihypertensive drug. Patients with coronary artery disease could experience an acute angina attack. *Concurrent administration of beta-adrenergic blocker such as propranolol*–Sodium and water retention is another serious potential side effect

**Cardiac Glycosides (Digoxin):** Increasing contractility or strength of myocardial contraction, a positive inotropic action. Digoxin accomplishes this by inhibiting NA+ K+ ATPase.
By increasing myocardial contractility, digoxin directly increases cardiac output, thus alleviating symptoms of HF and improving exercise tolerance.
- Also effecting impulse conduction in the heart.

**Positive Inotropes:** Increase myocardial contractility but may affect cardiac conduction.
**Negative Inotropes:** Decrease myocardial contractility.

**Phosphodiesterase Inhibitors:** Have serious toxicity that limits their use to patients with resistant heart failure who have not responded to ACE inhibitors, digoxin, or other therapies.
- Therapy is limited to 2-3 days and the patient is continuously monitored for ventricular dysrhythmias.
- If patient presents hypokalemia, it should be corrected prior to administration because it can increase the likeliness of dysrhythmias.
- These medications can also cause hypertension.

**Nitrates:** ability to relax both arterial and venous smooth muscle. Dilation of veins reduces the amount of blood returning to the heart (preload), so the chambers contain a smaller volume. Chest pain is alleviated and episodes of angina become less frequent.

**Short Acting:** Such as nitroglycerin, are taken sublingually to quickly terminate an acute angina episode.

**Long Acting:** Such as isosorbide Denitrate (isordil) are taken orally or delivered through a transdermal patch to decrease the frequency and severity of angina episodes.
- Also used to treat symptoms of heart failure, and their role in the treatment of symptoms of heart failure.
- Tolerance is common, usually develops rapidly, after only 24 hours of therapy it also disappears rapidly when the drug is withheld.
Patients are often instructed to remove the transdermal patch for 6 to 12 hours each day or withhold the night time dose of the oral med to delay the development of tolerance.

**Calcium Channel Blockers:** Exert beneficial effects on the heart and blood vessels by blocking calcium ion channels. They are used in the treatment of Hypertension and other cardiovascular diseases.

- Used more in African American and elderly populations who are sometimes less responsive to other drugs in antihypertensive classes.

*Contraction of muscle is regulated by the amount of calcium ion inside the cell.*

- At low doses, calcium channel blockers relax arterial smooth muscle, thus lowering peripheral resistance and decreasing blood pressure.

**Thrombolitics:** Quick restoration of cardiac circulation (reperfusion) with thrombolytic therapy reduces mortality caused by acute MI.

- After the clot is successfully dissolved, anticoagulant therapy is initiated to prevent the formation of additional clots.
- Most effective when administered from 20 minutes to 12 hours after onset of MI symptoms. If administered after 24 hours the drugs are mostly ineffective.
- Patients over 75 do not experience reduced mortality from thrombolytics.
- Dissolves any possibly clot formed in the body, can cause rupture of clots in brain, etc.

**Vasoconstrictors/Vasopressors:** In early stages of shock, the body compensates for the initial fall in blood pressure by activating the sympathetic nervous system. This produces vasoconstriction which raises BP and force of myocardial contractions. To maintain blood flow to vital organs such as the heart and brain, and to decrease flow to other organs, including the kidneys and liver.

- Vasopressors/vasoconstrictors are used to stabilize blood pressure in patients with shock.
- Given IV these drugs have rapid onsets with short durations and will immediately raise BP.
- Only used after fluid and electrolyte restoration has failed.
- These drugs are infused with pump and require an invasive line or other monitoring devices to ensure that real-time blood pressure and pulse rates can be assessed.

Vasopressors used to treat shock include dopamine, norepinephrine, phenylephrine, and epinephrine.

- **Dopamine** also affects strength of myocardial contraction and is considered both a vasopressor and an inotropic drug.
- **Epinephrine** is usually associated with treatment of anaphylaxis.

**Antihistamines:** Decrease inflammation and can treat motion sickness, insomnia and skin rashes.

- If using an antihistamine for allergies, patient has to start taking before allergy season for best results.
**Anticoagulants**- Know PT (16-20), INR (2-3 times on coumadin), aPTT (25-35 seconds)

**Antiplatelets**- Does NOT lower platelets level. They do not allow the platelets to bind together to form clots.
- Aspirin, 81mg, 325mg, 650mg (Given P.O)
  - No lab values except Hematocrit and Hematocrit
  - Tinnitus is side effect (not lethal)
  - No reversal, or dietary restrictions.

*A patient is on aspirin therapy 325mg P.O every day, patient has a hemoglobin of 9 and hematocrit of 29, what would be the next thing the nurse considers performing?*
- *Where is the patient bleeding from, test for occult blood (Both labs are low)*

**Subcutaneous Heparin (General Anticoagulant)**- Only given parenterally.
- Subcutaneous
  - IV push
  - IV drip

- Not very potent.
- No lab values because dose is so small. (5000/u subq), Thrombocytopenia
- Given for prevention of DVT

*Subcutaneous heparin is working if there are no signs of DVT.*
*Subcutaneous heparin is having adverse effects if there is bleeding.*

**Heparin Induced Thrombocytopenia**

**Plavix (clopidergrol) Antiplatelet**- No lab values, watch for overt or occult bleeding. No reversal agents.

**Warfarin**- P.O, Vitamin K inhibitor. Terrible bleeding is a side effect.
- Can never predict how warfarin is going to work with our patient.
- Lab values, INR(2-3ish) and PT(16-200.) While on warfarin.
- No foods high in vitamin K. (Green Leafy vegetables)
- Can't have teeth extracted or surgeries.

**Lovenox (Enoxaparin)**- N.O gas bubble in syringe, Subcutaneous injection ONLY.
- It is a low molecular weight heparin, patient can get H.I.T
- No lab values

**Rivaroxaban (factor x inhibitor), Dabigatran, etc- newer meds, no lab values.**

**Pentoxifyline (Trendal)**- Increases flexibility of cells to get into smaller places.
- Good for patients with peripheral vascular disease.
- And for pain in legs (intermittent claudication)

**Colony Stimulating Factors**- stimulate white blood cells

**Epogen (Erythropoietin)**- made by kidney tells bone marrow to make RBCs
- Given sub or IV, its working when hemoglobin=10 hematocrit rbc-over 8000

**Neupogen (Filgrastim)**- treats neutropenia, raising neutrophil counts.

**Neumega(oprelvekin)**- Stimulate platelets from bone marrow, for patients with thrombocytopenia.
(Watch platelet level)
**Immune Stimulants**- Stimulate the immune system.

  - **Interferons**- warn other cells that virus infection is occurring. *They attach to unaffected cells, when virus tries to attack cell, interferon inactivates the virus.*

  - **Interleukins**- enhance capability of immune system. Stimulate T-Cells, increase b-cell and plasma production, and promotion of inflammation.

**Immunosuppressants**- drugs used to inhibit the immune response, used for patients receiving transplanted tissues or organs and to treat severe inflammatory disorders.

- suppress some aspect of T-cell function.

  - **Corticosteroids/steroids are an immunosuppressant**

**Vaccines**- biological agents used to stimulate the immune system. Process of introducing foreign proteins or inactive cells(vaccines) into the body to trigger immune activation BEFORE the patient is exposed to the real pathogen.

- **Boosters**- follow up doses to provide sustained protection.

**Corticosteroids (Glucocorticoids)**- ability to suppress severe inflammation, short term treatment of severe disease. Treatment of asthma, arthritis, neoplasia, corticosteroid deficiency.

- **Prednisone is most common.**
  - Long term therapy may cause *cushion’s syndrome which includes, hyperglycemia, muscle weakness, bruising, easily fractured bones, excess hair distribution*

**Dexamethasone and Methylprednisolone**: Used to prevent chemotherapy induced and post surgical nausea and vomiting. They are used for short term therapy of acute cases because of the potential for serious long term adverse effects.

**Nephrotoxic Drugs**- Frequent kidney function tests are needed.

- **aminoglycosides**(most common)-infection
- **ACE inhibitors**- hypertension, heart failure
- **NSAIDS**- inflammation
- **Amphotericin B**- systemic anti-fungal infection.

**Antibiotics**- severe allergic reactions can occur. A full drug history and description of any reactions to those drugs is needed.

- **Penicillin has the highest allergic reactions.**

**Broad Spectrum antibiotics**- If viral infection is severe, lab tests will take several days. So broad spectrum antibiotics are given that treat a broad range of microbial species.

- Can cause “super-infections”, because they kill so many different species of organisms.

**Narrow Spectrum antibiotics**- after lab testing is done, narrow spectrum antibiotics may be given to treat a smaller variety of microbial species.

**Tuberculosis Drugs**- Must continue therapy for 6-12 months! Some patients may develop multi-drug resistant infections, therapy may be increased to 24 months!

- **At least 2, sometimes 4 antibiotics are given for therapy.**
**INH given with Vitamin b6!!!!!**

**Initial Phase** - 2 months of daily therapy with isoniazid, rifampin (rusty color tears, urine, and spit can happen), pyrazinamide, and ethambutol. If strain is sensitive to first 3 drugs, ethambutol is dropped.

**Continuation Phase** - 4 months of therapy with isoniazid and rifampin, 2-3 times per week.

**Isoniazid** - first line drug treatment for TB, most effective single drug for the infection.
- Give on empty stomach
- Deep IM, rotate sites.
- Pregnancy category C

Adverse - numbness of hands and feet, rash, and fever. Nerve toxicity is a concern during therapy. Pyridoxine is given for OD.

**HIV Medications** - aggressive treatment with multiple drugs, a regimen called **Highly Active Antiretroviral Therapy (HAART)**

**HAART** - Goal is to reduce plasma HIV RNA to its lowest possible level. Must be continued for the rest of the patients life.
- Nucleoside/nucleotide reverse transcriptase inhibitors
- Non-nucleoside reverse transcriptase inhibitors
- Protease inhibitors
- Entry inhibitors
- Integrase inhibitors

**what to watch for when giving Acyclovir (Zovirax)**: May cause painful inflammation of vessels at the site of infusion.
- Administer around the clock, even if sleep is interrupted.
- Administer with food

**Watch for nephrotoxicity and neurotoxicity when administering IV.**

**Also watch for resistance to drug is developing**

**Treatment of Malaria**: caused by 4 species of protozoan Plasmodium. Begins with a bite from an infected female Anopheles mosquito which is a carrier for the parasite.
- Plasmodium multiplies in the liver and transforms into progeny called merozoites.
- Drugs are used to interrupt the erythrocytic stage and eliminate the merozoites from red blood cells.
- Treatment is most successful if begun immediately after symptoms are recognized.

**Chloroquine is the traditional antimalarial** for treating the acute stage, although resistance has become a major clinical problem.

**H2 Receptor Antagonists** - are effective at suppressing the volume and acidity of parietal cell secretions. Available OTC for short term (2-weeks) treatment of GERD.

**Proton Pump Inhibitors (PPI)** - reduce acid secretion in stomach by binding irreversibly to H+, K+, - ATPase, the enzyme that acts as a pump to release acid. PPI reduce acid greater than H2 and have a longer duration of action. Only used for short term control of peptic ulcer and GERD.

**Anti-gas**
*Simethicone* in *Gas-X and Mylanta Gas*, reduces flatulence and gas.

**Antibiotics for Ulcers**: *Eradicate H. Pylori which is usually the main cause of peptic ulcer disease.*

**Magnesium, Aluminum preparations**: Combining aluminum compounds with magnesium increases their effectiveness and reduces potential for constipation.
- should not be used in patients who may have bowel obstruction.
Pepto Bismol (Bismoth)- compounds inhibit and prevent bacterial H. pylori from adhering to the gastric mucosa. Preventing ulcers.

Carfate (Sucralfate)- produces thick gel like substance that coats ulcer, protecting it from further erosion and promotes healing. Does NOT affect the secretion of gastric acid.

TUMS- antacid with calcium carbonate, decreases stomach acid. 
- Do NOT mix with milk or vitamin D, can cause milk-alkali syndrome. 
  - This may result in permanent renal damage if drug is continued at high doses.

Metamucil- bulk forming laxative. Swells and increases size of fecal mass, promotes passage of stool. If not enough water is taken with metamucil, psyllium may swell in esophagus and cause an obstruction. Drink and mix quickly, cellulose binds to food.

Lactulose- Saline and osmotic laxative and cathartic. Can cause diarrhea and abdominal cramping.

High blood glucose causes pancreas to release insulin, liver produces glycogen and the cells take up glucose from blood, lowering the blood glucose.

Low blood glucose causes the pancreas to release glucagon, the liver breaks down glycogen, and blood glucose rises.

Type 1 Diabetes Mellitus: previously called juvenile onset diabetes because it is often diagnoses between ages 11-13. Caused by autoimmune destruction of pancreatic beta cells, resulting in lack of insulin secretion.
  - Hyperglycemia: Greater than 126mg/dL fasting blood glucose on 2 separate occasions.
  - Polyuria- excessive urination
  - Polyphagia- increased hunger
  - Polydipsia- increased thirst
  - Glucosuria- high levels of glucose in urine.
  - Weight loss, fatigue

Type 2 Diabetes Mellitus: Most common form. Insulin resistance is characteristic, target cells become unresponsive to insulin due to a defect in insulin receptor function. Pancreas produces sufficient amount of insulin but target cells do not recognize it.
  - As cells become more resistant to insulin, blood glucose levels rise and pancreas responds by secreting even more insulin.

Insulin- to maintain more exact control of blood glucose levels.

Insulin aspart, lispro, glulisine- rapid acting, works in 5-30 mins, peaks .5-3 hours, take 5-10 mins before meal, can be mixed with intermediate, but draw aspart into syringe first!!

Insulin Regular- Short acting, works in 30-60 minutes, peaks 2-4 hrs, lasts for 5-7 hrs, subcutaneous 30-60 mins before meal, can mix with intermediate insulin.

Insulin Isophane (NPH)- intermediate acting, works in 1-2 hours, peaks in 4-12 hrs, lasts for 18-24 hrs, subq 30 mins before first meal and 30 mins before dinner. Can mix with rapid, NOT long.

Insulin Detemir and Glargine- Long acting, detemir- gradual over 24 hrs, glargine 1.1 hrs. Peaks 3-8 hrs, duration 10-24 hrs, detemir- with evening meal or bedtime. Glargine- subq once daily same time each day. DO NOT MIX WITH ANY OTHER INSULIN!!!
Thyroid Medications - highly individualized and requires careful, periodic adjustment.

Levothyroxine (levothroid, Synthroid) - synthetic form of T4, drug of choice for HYPOTHYROIDISM. May take 1-3 weeks to obtain full therapeutic benefits. Monitor TSH levels regularly. High TSH means dosage of T4 needs to be increased.

Methimazole: Has a much longer half life, less frequent doses and is the preferred antithyroid drug for treating thyroid storm.

Hypothyroidism - poorly functioning thyroid gland or low secretion of TSH. General symptoms are general weakness, muscle cramps, and dry skin.
   Lab values - Elevated TSH, diminished T3 and T4 levels. Replacement therapy of T3 and T4 for treatment.

Hyperthyroidism - increased body metabolism, tachycardia, weight loss, elevated body temp, and anxiety. Graves Disease is most common type of hyperthyroidism.

-Propylthiouracil (PTU) - treats hyperthyroidism, interfering with synthesis of T3 and T4. Prevents T4 to T3 synthesis in target tissue.
   -Administer with meals.
   -Pregnancy category D.
   -May increase PT time.

Radioactive Iodine I-131: because it is naturally concentrated in the thyroid gland, I-131 will immediately enter the thyroid and damage thyroid cells.

Potassium Iodine: If taken prior to or immediately following a nuclear incident, KI can prevent up to 100% of the radioactive iodine from entering the thyroid gland. Effective even if taken 3-4 hours after radiation exposure. Generally a single 130mg dose is necessary.

Adrenal Drugs - Corticosteroids

Long term use of Corticosteroids may cause Cushing’s Syndrome

Adrenocorticotropic Hormone (ACTH) - travels through blood to reach adrenal cortex causing it to release corticosteroids. Insufficient ACTH is called Addison’s Disease.

When exogenous corticosteroids are being given for long periods of time, they provide negative feedback to the pituitary to stop secreting ACTH. Without stimulation by ACTH, the adrenal cortex shrinks and stops secreting endogenous corticosteroids, a condition known as adrenal atrophy.

Pituitary Drugs: Growth hormone and Antidiuretic hormone have the most clinical utility.

Pituitary Hormones - Prolactin and oxytocin affect the female reproductive system.

Growth Hormone (Somatotropin) - stimulates the growth and metabolism of nearly every cell in the body, deficiency of this hormone in children can cause short stature, condition characterized significantly by decreased physical height compared to the norm. Administered subcutaneously.

Excess GH in adults is called acromegaly.

Desmopressin (DDAVP): most common drug for treating diabetes insidious (from a deficiency of ADH)
-synthetic analog of human ADH that acts on kidneys to increase the reabsorption of water.
-Oral route is preferred, also comes in intranasal and parenteral forms.
-Has a duration of up to 20 hours
-Vasopressin only 2-8 hours
-Desmopressin causes contraction of smooth muscle in vascular system, uterus, and GI tract.
-Given undiluted over 1 minute
-After IV, fluids must be restricted to prevent serious water intoxication.
-drowsiness, headache, nausea, listlessness that can progress to convulsions and coma.

Contraindicated with NSAIDS and carbamazepine.

Calcium and phosphorus, as **calcium goes up phosphorus goes down**, as phosphorus goes up calcium goes down.

Need **800-1200 mg/day of calcium.**

Normal serum calcium range **8.5-10 mg/dl**

**extremely low calcium** = cardiac toxicity, muscle spasms, severe degeneration of bones.

**Oyster Shells** = grind them up into calcium, ostell

**Calcium IV**
Sometimes calcium during cardiac arrest to stimulate the heart

*In order for calcium to work well, we need vitamin D.*

**Vitamin D deficiency in kids** = ricket’s

May give vitamin D with calcium supplements.

**Pharmacotherapy of osteoporosis**
-Treat with calcium and vitamin D
-Large recommended of vitamin D daily.
-**5 different types of meds for osteoporosis**
-Calcium supplements (oyster shell calcium) and vitamin D combo.
-**Biphosphonates**- terribly eroding for stomach, patient has to sit up for at least 2 hours after taking meds because it can come up esophagus and burn a hole through it.
-Selective Estrogen receptor modulators- increase bone reabsorption and increase bone density.
-Calcitriol
-Calcium fluoride

**Alendronate (Fosamax)**- inhibit break down of bones, by inhibiting osteoclasts. Lowers serum phosphorus level.

**Raloxifene (Evista)**- increases bone mass and density by acting through estrogen receptor
-migraines, hot flash, breast tenderness, flu like symptoms, all even in men too….not to be given to pregnant people.

**Vitamin D therapy**
**Calcitriol (Calcijex- injection, Rocaltrol-liquid elixer)**- an active form of vitamin D
-patients phosphorus levels with renal failure are high, they retain phosphorus
Osteoarthritis- wear and tear of cartilage and joints from aging, normal process. Only affects joints.
_treat with NSAIDS, lower doses in older people._

Rheumatoid arthritis- kids can get it, not just a joint disease, a systemic autoimmune disease
_Treat with NSAIDS at first, if inflammation is severe then immune suppression with corticosteroids_
Disease-Modifying anti-rheumatic drugs- used for rheumatoid arthritis only

Gout- buildup of uric acid in blood or joint cavaties. Pain and inflammation in ONE joint, usually in big toe.

Alopurenol (zyloprim)- P.O
_Colchicine (colcys)-P.O, this helps with inflammation with acute attack_

Scabies- bugs that tunnel underneath skin.

Lice- bugs that are on top of skin or in hair
Both are treated with lyse meds, slather lotion on patient do not wash or shower for a day, scabies dead.

Accutane for acne, never be touched if pregnant. Highly teratogenic.

Eyes:
Glaucoma medications
-prostaglandin analogs
_Latanoprost (Xalatan)_- reduces intraocular pressure by increasing outflow of aqueous humor. Cant use for acute/narrow glaucoma. changes color of eyes, look like black eyes, photophobia, visual disturbances.

-beta adrenergic blockers
_Timolol (Timoptic, Timoptic XE)_- beta blocker drop, administer eyedrops by pulling down lower eye lids and hold their tear duct shut so the eye drops don't go in duct and cause bradycardia, hypotension.

_Dont give anti-cholinergic to patients with glaucoma, atropine is one of them_

-Alpha2 adrenergic blockers

Ears- can get infected, ear drops antibiotics to treat.

Ampotericin B (Fungizone): Broad spectrum of activity an is effective against most of the fungi pathogenic to humans, preferred drug for many systemic mycoses.
-Can also be used as prophylactic anti fungal therapy for patients with severe immunosuppression.
-Several months of therapy may be required for complete cure.
-infuse slowly because of cardiovascular collapse if infused too rapidly.
-administer pre meds such as acetaminophen, antihistamines, and corticosteroids to decrease risk of hypersensitivity reactions.
-Withhold if BUN exceeds 40mg/dl or serum creatine above 3mg/dL

Adverse: fever, chills, vomiting, headache at beginning of therapy. Phlebitis is common during IV therapy. Some degree of nephrotoxicity is observed in 80% of patients.
electrolyte imbalances such as hypokalemia.
    -Cardiac arrest, hypotension, and dysrhythmias are possible.
    -CAN cause ototoxicity.

**Do not use with aminoglycosides, vancomycin, or carboplatin.**

**Use with digoxin increases risk of digoxin toxicity.**

**Blood tests are needed.**

**Azoles:** consist of 2 different chemical classes
    - Imidazoles
    - Triazoles

These drugs interfere with biosynthesis of ergosterol, which is essential for fungal cell membranes.
- Broad spectrum and are used to treat nearly any systemic, cutaneous, or superficial fungal infection.
- The remainder of azoles are prescribed for superficial infections.

**Metronidazole (Flagyl):** Is an anti infective, antiprotozoan. Used to treat a number of respiratory, bone, skin, and CNS infections.
    - Extended release form must be swallowed and taken on empty stomach.
    - Metronidazole is contraindicated during the first trimester of pregnancy.

Most common Adverse: anorexia, nausea, diarrhea, dizziness, and headache. Dryness of mouth and an unpleasant metallic taste may be experienced.
Although rare, bone marrow suppression can occur.

- Interacts with oral anticoagulants to potentiate hypoprothrombinemia, and alcohol.