

# Pharmacology Study Guide

## Table of Contents

- Analgesic Drugs 2
  - Opioid Analgesics 2
  - Nonopioid Analgesics 3
    - Acetaminophen (Tylenol) 3
    - NSAIDs 4
- Anesthetics 5
  - General anesthetics 5
  - Drugs for moderate sedation 5
  - Local anesthetics 6
  - Neuromuscular Blocking Drugs 6
- Antibiotics 8
  - Sulfonamides 8
  - Cephalosporins 8
  - Penicillins 9
  - Tetracyclines 9
  - Macrolides 9
  - Aminoglycosides 10
  - Quinolones 10
- Cardiovascular Medications 12
  - ACE Inhibitors 12
  - Beta Blockers 12
  - ARBs 13
  - CCBs 13
  - Vasodilators 14
  - Alpha<sub>1</sub> Blockers 14
  - Loop Diuretics 15
  - Potassium-Sparing Diuretics 15
  - Thiazides 16
  - Cardiac Glycosides 16
  - Antidysrhythmics 17
  - Anticoagulants 18
  - Antiplatelets 19
  - Thrombolytic Drugs 19
  - Statins 20
  - Bile Acid Sequestrants 20
  - Niacin 21
  - Fibrates 21

- Endocrine Medications 22
  - Pituitary Drugs 22
  - Thyroid Drugs 23
  - Antithyroid Drugs 23
  - Corticosteroids 24
  - Diabetes Drugs 25
    - Insulins 25
    - Oral Diabetic Drugs 26
      - Biguanide 26
      - Sulfonylureas 26
      - Glinides 26
      - Glitazones 26
- Female Sex Hormones 28
  - Estrogens 28
  - Progestins 28
- Male Sex Hormones 29
  - Androgens 29
- Gastrointestinal Medications 30
  - Antacids 30
  - H<sub>2</sub> Receptor Antagonists 30
  - PPIs 31
  - Sucralfate 31
  - Antidiarrheals 32
  - Drugs for Irritable Bowel Syndrome 32
  - Laxatives 33
  - Antiemetics 34
- Respiratory Medications 35
  - Antihistamines 35
  - Decongestants 35
  - Antitussives 36
  - Expectorants 36
  - Bronchodilators 37
    - Beta-adrenergic agonists 37
    - Anticholinergics 37
    - Xanthine Derivatives 37
  - Nonbronchodilating 38
    - Leukotriene Receptor Antagonists 38
    - Corticosteroids 38

- Psychotropic Drugs 40
  - Antianxiety & Hypnotic Drugs 40
    - Benzodiazepines 40
    - Z-Hypnotics 40
    - Doxepin 40
    - Melatonin Receptor Agonists 40
    - Suvorexant 41
    - Buspirone 41
  - Antidepressant Drugs 41
    - SSRIs 41
    - NaSSAs 42
    - Serotonin Modulator & Stimulator 42
    - SARIs 42
    - NDRIs 42
    - TCAs 43
    - SNRIs 43
    - MAOIs 43
  - Mood Stabilizers 44
    - Lithium 44
  - Anticonvulsant Drugs 44
    - Valproate 44
    - Carbamazepine 44
    - Lamotrigine 44
  - Drug Tx for ADHD 45
    - Psychostimulants 45
    - Nonstimulants 45
  - Antipsychotic Drugs 45
    - FGAs 45
    - SGAs 46
    - Side effects of antipsychotics 46
  - Alzheimer's Dz Drug Tx 47
    - Cholinesterase Inhibitors 47
    - NMDA Receptor Antagonist 47



# Analgesic Drugs

- **Analgesics** - meds that relieve pain without causing loss of consciousness; consist of opioids and nonopioids
- **Patient-controlled analgesia (PCA)** - patient is able to self-medicate by pressing a button on a PCA infusion pump
- **Opioid tolerance** - state of adaptation; exposure to a drug causes changes in drug receptors that result in decreased drug effects over time
- **Analgesic ceiling effect** - drug reaches a maximum analgesic effect; analgesia does not improve with higher dose
- **Adjuvant drugs** - assist the primary drugs in relieving pain; help decrease amount of opioids used and adverse effects; e.g. NSAIDs, antidepressants, antiepileptic drugs; corticosteroids
- **3-step analgesic ladder** -
  - Step 1: use of nonopioids (with or w/o adjuvant meds)
  - Step 2: use of opioids (with or w/o nonopioids or adjuvant meds)
  - Step 3: use of opioids indicated for moderate to severe pain (with or w/o nonopioids or adjuvant meds)

## Opioid Analgesics

### Mechanism of Action:

- **Agonists**: bind to opioid pain receptor in the brain and causes an analgesic response
- **Agonists-Antagonists (partial agonists)**: bind to opioid pain receptor and causes a weaker pain response
- **Antagonists (nonanalgesics)**: binds to a pain receptor but does not cause analgesic response (competes with agonist or agonist-antagonist)

### Indications:

- Alleviate moderate to severe pain
- Combined with anesthetic during surgery
- Management of postoperative and procedural pain
- For long-term pain mgmt (transdermal fentanyl)
- Cough suppression (codeine, hydrocodone)
- Diarrhea
- Reverse respiratory depression secondary to opioid overdosage (Naloxone)

### Contraindications:

- Severe asthma
- Caution: respiratory insufficiency; morbid obesity; sleep apnea; myasthenia gravis; paralytic ileus; pregnancy

### Adverse effects:

- All have strong potential for abuse
- CNS depression (may lead to respiratory depression)
- Nausea; vomiting; constipation
- Hypotension; bradycardia
- Itching; rash; pruritus
- Urinary retention

### Interactions:

- Alcohol
- Antihistamines
- Barbiturates
- Benzodiazepines
- Phenothiazine
- Other CNS depressants
- MAOIs

### Opioid Agonists:

- alfentanil (Alfenta)
- codeine sulfate
- fentanyl (Duragesic, Oralet, Actiq)
- heroin
- hydrocodone (Hysingla, Vicodin [with acetaminophen])
- hydromorphone (Dilaudid)
- meperidine hydrochloride (Demerol)
- methadone hydrochloride (Dolophine)
- morphine sulfate (Kadian, MS Contin)
- oxycodone (Oxy IR, OxyContin, Percocet [with acetaminophen])
- remifentanil (Ultiva)
- sufentanil (Dsuvia, Sufenta)

### Opioid Agonists-Antagonists:

- buprenorphine (Buprenex)
- butorphanol (Stadol)
- nalbuphine (Nubain)
- pentazocine (Talwin)

### Opioid Antagonists:

- naloxone hydrochloride (Narcan)



### Black Box Warning

High potential for abuse and respiratory depression  
Risk of combined use with benzodiazepines:  
extreme sleepiness, respiratory depression,  
coma, death



# Analgesic Drugs

## Considerations / Patient Education

- Mild pain - use nonopioid drugs and nonpharm measures
- Moderate to severe pain - use opioids using stepped approach
- Check 9 rights and administer as ordered before pain gets out of control
- Monitor vitals with special attn to any respiratory changes; 10-12 breaths/min must be reported to prescriber
- Naloxone must always be available
- Monitor UO, bowel sounds, pupillary reaction to light (pinpoint pupils indicate a possible overdose)
- Must know equianalgesia (able to compare meds and give comparable analgesia)
- Give oral dose with food
- Chewing or crushing of any extended-release opioid drug can cause oversedation, respiratory depression and even death
- May need antiemetic if N/V
- Keep bedside rails up and call bell within reach to prevent falls/injury related to opioid use
- Morphine - if decline in pt's condition or abnormal vitals- withhold drug and contact prescriber
- Patch - apply to clean, nonhairy area; use new site when changing; clean old site thoroughly before applying new patch; monitor for contact dermatitis; maintain pain journal at home
- IV dosing - monitor pain levels, response to meds, vitals, IV needle site, infusion rates
- PCA - keep track of amount/timing of doses; monitor equipment often
- Overdose - Naloxone via IV; diluted; administer slowly as ordered
- Opioid agonists-antagonists: if given at same time as other opioids leads to reversal of analgesia and acute withdrawal
- If pain present for >12 hours/day best to administer around the clock
- Each patient's pain needs are individualized
- Educate:
  - Do not use alcohol or other CNS depressant
  - Know ingredients of OTC meds
  - For constipation: force fluids up to 3 L/day, ↑ fiber, exercise, may need stool softeners
  - Encourage to share any history of addiction
  - May need combo of meds to control pain
  - Report: dizziness, difficulty breathing, ↓ BP, sedation, confusion, loss of memory, N/V

## Nonopioid Analgesics

- acetaminophen (Tylenol)
- NSAIDS

## Acetaminophen (Tylenol)

### Mechanism of Action:

- Blocks peripheral pain impulses by inhibition of prostaglandin synthesis
- Acts on hypothalamus (regulates body temperature)

### Indications:

- Treatment of mild to moderate pain and fever
- Substitute for aspirin
- Children and adolescents with flu

### Contraindications:

- Severe liver disease
- G6PD deficiency

### Adverse effects:

- Skin disorders; N/V
- Hepatotoxicity; blood disorders
- Nephrotoxicity

### Interactions:

- Alcohol; phenytoin
- Barbiturates
- Warfarin
- Isoniazid
- Rifampin; beta blockers
- Anticholinergic drugs



# Analgesic Drugs

## NSAIDS

Have analgesic, antiinflammatory and antipyretic properties

### Mechanism of Action:

- Block chemical activity of the enzyme cyclooxygenase (COX)
- Aspirin - inhibits platelet aggregation

### Indications:

- Mild to moderate headache
- Myalgia; neuralgia; arthralgia
- Alleviate postop pain
- Arthritis - rheumatoid, juvenile, osteo
- Gout; hyperuricemia
- Aspirin - ↓ cardiac death after MI
- Chronic pain - bone cancer; back pain
- Provide opioid-sparing effect when given with opioid

### Contraindications:

- Risk for bleeding (Vit K deficiency, PUD); aspirin allergy
- Third trimester pregnancy; lactating women

### Adverse effects:

- GI tract - Many - from heartburn to GI bleeding
- Acute renal failure (especially if dehydrated)
- ↑ risk of heart attack or stroke (except aspirin)

### Interactions:

- Alcohol
- Anticoagulants
- Aspirin and other salicylates (w/other NSAIDS)
- Biphosphonates
- Corticosteroids
- Cyclosporine; lithium
- Diuretics and ACE inhibitors
- Herbals: feverfew, garlic, ginger, ginkgo



### Black Box Warning

All NSAIDS (except aspirin) - increased risk for heart attack or stroke

All NSAIDS - increased risk for serious GI events

### Most common:

- aspirin (Bayer, others)
- celecoxib (Celebrex)
- ibuprofen (Motrin, Advil)
- indomethacin (Indocin)
- ketorolac (Toradol)
- meloxicam (Mobic, Vivlodex)
- nabumetone (Relafen)
- naproxen (Aleve, Naprosyn)

## Salicylates

- Type of NSAID
- Most common is aspirin (available OTC)
- Other salicylates (prescription): diflunisal (Dolobid); choline magnesium trisalicylate (Trilisate); salsalate (Salsitab)
- Topical form: Aspercreme
- Aspirin -
  - With acetaminophen & caffeine (e.g. Excedrin)
  - Aspirin/antacid combinations (e.g. Bufferin)
  - Enteric-coated aspirin (e.g. Ecotrin)
  - Indications: pain from headache, neuralgia, myalgia, arthralgia, arthritis, pleurisy, pericarditis; fever
  - Contraindications: children and teenagers (risk of Reye's syndrome)

## Considerations / Patient Education

- Acetaminophen:
  - Monitor for chronic acetaminophen poisoning
    - S/S: rapid, weak pulse, dyspnea, cold, clammy extremities
  - Monitor liver fnx studies
  - Instruct pt on how to read labels to look for acetaminophen and s/s of overdose: bleeding, loss of energy, fever, sore throat, easily bruising → report immediately
- Nonaspirin NSAIDs
  - Do not crush/chew enteric-coated or sustained-released
  - Oral forms give with food or antacids to ↓ GI upset
  - Avoid other ulcerogenic substances (e.g. alcohol, prednisone)
  - High dose or long-term tx: monitor lab results
  - IM injections - slowly into large muscle mass
  - Immediately report: moderate to severe GI upset; dyspepsia with nausea, vomiting, ab pain, blood in stool or vomitus
- Aspirin:
  - Do not give to children/teens and caution w/older adults
  - Vinegary odor of aspirin = chemical breakdown
  - Pt w/asthma, wheezing, respiratory problems = increased incidence of allergic reactions
  - 'Aspirin triad' - asthma, nasal polyps and rhinitis = puts pt at risk for reactions to aspirin
  - Cardioprotection - usually in lower doses (e.g. 81 mg)
  - Be on lookout for s/s of aspirin toxicity: GI and other sites of bleeding and ab pain - report immediately
  - As antipyretic - temperature will decrease in about 1 hr
- All NSAIDS - usually discontinue 1 week before any type of surgery including oral and dental



# Anesthetics

- Anesthetics - drugs that reduce or eliminate pain by depressing nerve function in the CNS and/or PNS. Include:
  - General anesthetics
  - Moderate (conscious) sedation
  - Local anesthetics
  - Neuromuscular blocking drugs (NMBDs)
- Anesthesia - state of reduced neurologic function
- Monitored anesthesia care (MAC) - planned procedure; pt undergoes local anesthesia along with sedation and analgesia; allows pt to be discharged soon after procedure
- Adjunct anesthetics - used simultaneously w/general anesthesia for anesthesia induction, sedation, reduction of anxiety and amnesia; include NMBDs, benzodiazepines, barbiturates and sedative-hypnotics among others

## General Anesthetics

- Parenteral
- Inhalational

- Provides complete loss of consciousness and loss of body reflexes including respiratory muscles
- Requires mechanical or manual ventilatory support to avoid brain damage and suffocation
- Given only under controlled conditions by anesthesia providers
- Often uses more than 1 drug

### Parenteral:

- etomidate (Amidate)
- ketamine (Ketalar)
- methohexitol (Brevital)
- propofol (Diprivan)
- thiopental (Pentothal)

### Inhalational Gas:

- nitrous oxide

### Inhalational Liquid:

- desflurane (Suprane)
- isoflurane (Forane)
- sevoflurane (Ultane)

### Mechanism of Action:

- Not 100% known; perhaps related to lipid solubility and ability to cross the blood-brain barrier to nerve cell membranes

### Indications:

- To produce unconsciousness
- To relax skeletal and visceral smooth muscles for surgical procedures or electroconvulsive therapy

### Contraindications (varies per med):

- Pregnancy; narrow-angle glaucoma
- Acute porphyria; known susceptibility to malignant hyperthermia

### Adverse effects (varies per med):

- Hypotension; postoperative nausea and vomiting (PONV)
- Malignant hyperthermia - uncommon but potentially fatal; genetically linked adverse reaction to anesthesia; S/S: rapid rise in body temp, tachycardia, tachypnea, muscular rigidity; Tx: cardiorespiratory supportive care

- All general anesthetics have rapid onset of action and are eliminated rapidly upon discontinuation.
- Must be maintained intraoperatively by continuous administration of the drug.

### Interactions:

- Antihypertensives; beta blockers

## Drugs for Moderate Sedation

- 'Conscious sedation' or 'procedural sedation'
- Does not cause complete loss of consciousness and does not normally cause respiratory arrest
- Pt relaxes with little to no anxiety and is able to maintain airway and respond to verbal commands

- May cause amnesia (not 100% guaranteed)
- More rapid recovery time vs general anesthesia

### Commonly used:

- Short-acting benzodiazepine (usually midazolam) with a short-acting opioid (usually fentanyl or morphine)
- Propofol



# Anesthetics

## Local Anesthetics

- Provides elimination of pain sensation in the tissues innervated by anesthetized nerves
- Does not produce paralysis of respiratory function or loss of consciousness
- Spinal: anesthetic drugs injected into area near spinal cord; intrathecal or epidural
- Peripheral: infiltration (injected into tissue); nerve block (injected at site near nerve)

- Parenteral
  - Peripheral
  - Spinal/Neuraxial
- Topical

### Parenteral:

- bupivacaine (Marcaine, Sensorcaine)
- chloroprocaine (Nesacaine)
- lidocaine (Xylocaine)
- mepivacaine (Carbocaine)
- procaine (Novocain)
- tetracaine (Pontocaine)

### Topical:

- benzocaine (Dermoplast, Lanacane)
- dibucaine (Nupercainal)
- dyclonine (Dyclone, Sucrets)
- lidocaine (Lidoderm)

### Mechanism of Action:

- Leaves a specific portion of the body insensitive to pain by blocking nerve transmissions
- Affects only area where anesthetic is applied
- No loss of consciousness

### Indications:

- Surgical, dental, diagnostic procedures
- Some chronic pain
- Spinal during childbirth

### Contraindications:

- Known drug allergy

### Adverse effects:

- Spinal: spinal headache - either from inadvertent dural puncture or intrathecal anesthesia
- Allergic reaction - rare; s/s: skin rash, urticaria, edema, anaphylactic shock

### Interactions:

- Enflurane
- Halothane
- Epinephrine

## Neuromuscular Blocking Drugs

- Produce paralysis in skeletal and smooth muscles including intercostal muscles and diaphragm → mechanical vent required before administration; High alert drug!
- Among most commonly used drugs in operating room for intubation with endotracheal tube or to relax skeletal muscles
- Do NOT cause sedation or relieve pain or anxiety: MUST be used with pain and anxiety meds

- Depolarizing
- Nondepolarizing

### Depolarizing:

- succinylcholine (Anectine, Quelicin)

### Nondepolarizing:

- cisatracurium (Nimbex)
- rocuronium (Zemuron)
- vecuronium (Norcuron)
- pancuronium (Pavulon)
- atracurium (Tracrium)

### Mechanism of Action:

- Depolarizing - compete against acetylcholine for receptors at end of muscle nerves
- Nondepolarizing - block acetylcholine at receptors

### Indications:

- Maintain skeletal muscle paralysis to facilitate controlled ventilation during surgical procedure

### Contraindications:

- Known drug allergy
- Previous h/o malignant hyperthermia
- Penetrating eye injuries
- Narrow-angle glaucoma; burns
- Recent CVA; crush injuries

### Adverse effects:

- Muscle spasms (fasciculations) - may damage muscles leading to hyperkalemia
- Bronchospasm; hypotension
- Excessive bronchial and salivary secretion

### Interactions:

- Inhalation or local anesthetics
- Aminoglycosides
- Calcium channel blockers
- Clindamycin
- Cyclosporine
- Furosemide
- Quinidine
- Carbamazepine
- Corticosteroids
- Phenytoin



# Anesthetics

## Considerations / Patient Education

- Nurses do not give anesthetics unless s/he is an anesthesia provider! (Exception for the topical forms)
- Assess: ABCs, alcohol use, nicotine use
- MUST closely observe pt before, during and after administration
- Focus on ABCs, vitals, O<sub>2</sub> sat levels (by pulse oximetry) and clinical presentation
- General anesthesia -
  - Assess temp (risk for malignant hyperthermia)
  - Have resuscitative equipment and meds available
  - Continuously monitor status of breath sounds
  - O<sub>2</sub> administered (will need order) after anesthesia administered
  - Monitor supine and standing blood pressure
  - Monitor neurologic reflexes; response to commands, LOC, pupillary reaction to light
  - Monitor movement in extremities, distal pulses, temp
  - Pain relief after anesthesia - administer cautiously (b/c already given pain meds with anesthesia)
- NMBDs -
  - May need more meds for sedation and pain
  - Check vitals and neurologic status
  - Educate family on need for meds to paralyze for intubation and that pt will still be able to hear them

- Spinal -
  - Constantly monitor for return of sensation and motor activity
  - Monitor respirations and breathing status
  - Keep HOB elevated
  - Monitor for sudden ↓ in BP, vitals, O<sub>2</sub> sat levels
- Central/neuraxial -
  - Watch for spinal headache
  - Keep pt hydrated and on bed rest
- Epidural -
  - Measure vitals and O<sub>2</sub> sat levels
  - Monitor for return of motor function and tactile sensation
  - Assess touch sensation through hand pressure or gentle pinch of the skin
- Local/topical -
  - Do not use solutions that are cloudy or discolored
  - Ointment/cream - cleanse and dry area to be anesthetized
  - Do NOT swallow unless prescriber instructs
- Educate -
  - Inform pt of anesthetic, route of administration, adverse effects and special precautions
  - Discuss all patient's fears
  - Instruct on postanesthesia process: monitoring vitals, breath sounds, neurologic intactness
  - Encourage mobility after procedure as needed and ordered (with assistance)
  - Encourage to request pain meds before pain gets severe



# Antibiotics

## Antibiotics

- Bacteria classification w/Gram stain procedure:
  - Gram-positive: very thick cell wall and thick outer capsule
  - Gram-negative: smaller cell wall and outer capsule BUT also 2 cell membranes: Harder to treat!
- Subtherapeutic - when s/s do not improve w/treatment
- Superinfection - when abx reduce or completely eliminate the NORMAL bacterial flora
- Antibiotic resistance - considered one of the world's most pressing public health problems; due to overprescribing of abx and pt not completing regimen

- 3 uses of antibiotics:
  - Empiric therapy: organism not identified yet; use abx known to kill most common causes of infection
  - Definitive therapy: once organism is identified, abx therapy adjusted
    - Broad-spectrum abx: act against gram +, gram - and anaerobic bacteria
    - Narrow-spectrum abx: act against just a few organisms
  - Prophylactic therapy: used when pt scheduled to undergo a procedure where the likelihood is high of contamination (given 30 minutes before)

- Sulfonamides
- Cephalosporins
- Penicillins
- Tetracyclines
- Macrolides
- Aminoglycosides
- Quinolones

All antibiotics decrease the effectiveness of oral contraceptives

## Sulfonamides

### Mechanism of Action:

- Inhibit growth of bacteria by preventing bacterial synthesis of folic acid

### Indications:

- UTIs; respiratory tract infections
- Prophylaxis for HIV pts; outpatient Staph infections

### Contraindications:

- KDA; pregnant women at term
- Infants younger than 2 months
- Patients with G6PD or slow acetylation

- Sulfamethoxazole combined with trimethoprim (Bactrim, Septra, SMZ-TMP)

### Adverse effects:

- Allergic rxn (s/s: fever followed by rash)
- Photosensitivity
- GI: N/V; diarrhea; pancreatitis; hepatotoxicity
- Convulsions; crystalluria; headache; urticaria; cough

### Interactions:

- Sulfonylureas; phenytoin; warfarin; oral contraceptives

## Cephalosporins

### Mechanism of Action:

- Interfere with bacterial cell wall synthesis
- Structurally and pharmacologically related to penicillins
- Semisynthetic

Five generations; gram-negative coverage increases with each successive generation

### Indications:

- \*Broad spectrum\*
- Surgical prophylaxis; staphylococcal infections
- Meningitis; pneumonia
- Intraabdominal infections; difficult UTIs

### Contraindications:

- KDA to penicillin and cephalosporins

\*All begin with cef-

### First generation

- cefazolin (Ancef)
- cephalexin (Keflex)

### Second generation

- cefoxitin (Mefoxin)
- cefuroxime (Zinacef, Ceftin)

### Third generation

- ceftriaxone (Rocephin)
- ceftazidime (Ceptaz, Fortaz)

### Fourth generation

- cefpime (Maxipime)

### Fifth generation

- ceftaroline (Teflaro)

### Adverse effects:

- Mild diarrhea; ab cramps; rash; pruritus; edema

### Interactions:

- Alcohol; antacids; iron; probenecid
- Oral contraceptives



# Antibiotics

## Penicillins

Be aware: Many penicillin names end in -cillin  
but not the trade name

### Mechanism of Action:

- Interfere with bacterial cell wall synthesis

### Indications:

- Prevention and tx of infections caused by susceptible bacteria
- Usually kill gram-positive bacteria

### Contraindications:

- KDA

### Interactions:

- Aminoglycosides; methotrexate
- NSAIDs; oral contraceptives
- Probenecid; rifampin; warfarin

### Adverse effects:

- Urticaria; pruritus; angioedema
- Lethargy; anxiety; depression
- N/V; diarrhea; taste alterations
- Anemia; granulocytopenia
- Hyperkalemia; hypernatremia

- penicillin G potassium (Pfizerpen)
- penicillin V potassium (Pen-Vee K)
- cloxacillin (Cloxapen)
- dicloxacillin (Dycill, Dynapen)
- nafcillin (Nallpen)
- oxacillin (Bactocill)
- amoxicillin (Amoxil)
- ampicillin (Omnipen)
- piperacillin (Pipracil)
- ticarcillin (Ticar)
- carbenicillin (Geocillin)

### Combined w/beta-lactamase inhibitor:

- ampicillin & sulbactam (Unasyn)
- amoxicillin & clavulanic acid (Augmentin)
- ticarcillin & clavulanic acid (Timentin)
- piperacillin & tazobactam (Zosyn)

## Tetracyclines

### Mechanism of Action:

- Inhibit protein synthesis in bacteria

### Indications:

- Syphilis; Lyme disease; SIADH; cholera
- Pelvic inflammatory disease; acne
- Rocky Mountain spotted fever
- Typhus; mycoplasma pneumonia

### Interactions:

- Antacids; antidiarrheals; dairy products; calcium
- Enteral feedings; iron preps
- Bactericidal abx; oral anticoagulants
- Oral contraceptives

### Contraindications:

- KDA; pregnant or lactating women
- <8 years old (will discolor teeth)

### Adverse effects:

- Discoloration of permanent teeth
- Fetus - tooth enamel hypoplasia; slow fetal skeletal development
- Photosensitivity
- Diarrhea; vaginal candidiasis
- Thrombocytopenia
- Coagulation irregularities
- Gastric upset
- Maculopapular rash

- demeclocycline (Declomycin)
- oxytetracycline (Terramycin)
- tetracycline (Ala-tet, Brodspec, others)
- doxycycline (Acticlate, Adoxa, others)
- minocycline (Dynacin, Minocin, others)
- tigecycline (Tygacil)

Tetracyclines have the ability to bind to divalent and trivalent metallic ions; therefore cannot be administered with milk, antacids or iron salts (will cause considerable reduction in the oral absorption)

## Macrolides

### Mechanism of Action:

- Inhibit protein synthesis in bacteria

### Indications:

- Infections caused by streptococcus pyogenes
- Upper & lower resp tract infections caused by Haemophilus influenzae
- Syphilis; gonorrhea; Lyme disease
- Chlamydia; delayed gastric emptying in diabetics

### Contraindications:

- KDA

### Adverse effects:

- Palpitations; chest pain; QT prolongation
- Headache; dizziness; vertigo
- N/V; diarrhea; heartburn; anorexia
- Rash; urticaria; hearing loss

- azithromycin (Azasite, Zithromax)
- clarithromycin (Biaxin)
- erythromycin (E.E.S. Granules, Ery-Tab)
- fidaxomicin (Dificid)

### Interactions:

- Carbamazepine; cyclosporine; theophylline
- Warfarin; moxifloxacin
- Pimozide; thioridazine
- Oral contraceptives
- Simvastatin; lovastatin



# Antibiotics

## Aminoglycosides

Potent!  
Used for virulent infections.

- Therapeutic drug monitoring necessary due to the potential for nephrotoxicity and ototoxicity
- Dosed according to level of renal function
- Drug plasma concentration needs to be high (8x MIC) for bacterial kill → often given in 1 daily dose
  - Trough level measurement taken 8-12 hrs after completion of dose administration (goal at or below 1 mcg/mL)
- Serum creatinine level also monitored
- May also give 3x/day (peak and trough levels measured)
- Lung infections - dose given via inhalation

- amikacin (Amikin)
- gentamicin (Garamycin, Cidomycin)
- kanamycin (Kantrex)
- neomycin (Mycifradin, Neo-Fradin)
- streptomycin (generic)
- tobramycin (Tobi, Nebcin)

### Contraindications:

- KDA
- Pregnant

### Adverse effects:

- Nephrotoxicity (reversible) - s/s: urinary casts; proteinuria; ↑ BUN and serum creatinine levels
- Ototoxicity (varying degrees of permanent hearing loss) - s/s: dizziness; tinnitus; sense of fullness in ears; hearing loss
- Headache; paresthesia; vertigo; skin rash; fever

### Interactions:

- Vancomycin; cyclosporine; amphotericin B
- Loop diuretics; warfarin; NMBDs

## Quinolones

Potent!  
Used for virulent infections.

### Mechanism of Action:

- Destroy bacteria by altering their DNA
- Mostly kill gram-negative bacteria

### Indications:

- Complicated UTIs
- Respiratory, skin, GI, bone and joint infections

### Contraindications:

- KDA

### Interactions:

- Antacids; Ca, Mg, Fe, Zn preps; sucralfate; dairy - must take med 1 hr before or after
- Enteral tube feedings
- Probenecid; nitrofurantoin
- Oral anticoagulants

- norfloxacin (Noroxin)
- ciprofloxacin (Cipro)
- levofloxacin (Levaquin)
- moxifloxacin (Avelox)
- gemifloxacin (Factive)
- delafloxacin (Baxdela)

### Black Box Warning

Quinolones have increased risk for tendinitis and tendon rupture, peripheral neuropathy, CNS effects, exacerbation of myasthenia gravis



# Antibiotics

## Considerations / Patient Education

- Culture specimens must be obtained before drug therapy initiated in order to properly ID causative organism
- Pt must take as ordered, for length of time, around the clock
- Take with fluids/foods as indicated
- Do not omit dose or double up
- Do not give with antacids, Ca supps, iron products, laxatives with Mg
- Assess for reactions continuously (may take a while to show up):
  - Look for: wheezing, SOB, swelling of face, tongue, hands, itching and rash
  - If noted, stop dosage immediately and contact prescriber; monitor pt
- Watch for superinfection - s/s: fever, lethargy, mouth sores, perineal itching
- Sulfonamides:
  - Make sure no allergic reaction to sulfa-type drugs and/or sulfites
  - Avoid in pts w/G6PD and slow acetylation
  - Encourage ↑ in fluids (2-3L/24 hr)
  - Oral doses take with foods to ↓ GI upset
  - Report: worsening ab cramps, stomach pain, diarrhea, blood in urine, rash, SOB, fever
- Cephalosporins -
  - Check for allergy to penicillins (cross-sensitivity)
  - Give with food
  - Avoid alcohol
  - Double-check drug names
- Penicillins:
  - Check history for asthma, aspirin allergy, sensitivity to cephalosporins (may be higher risk for penicillin allergy)
  - Check for electrolyte disturbances (some penicillin preps have ↑ Na and K ion concentrations)
  - C.difficile may flourish in GI tract when taking penicillin - probiotics will prevent this; products with Lactobacillus, supplements, yogurt, buttermilk, kefir
  - Take w/at least 6 oz water (not juices-too acidic)
- Tetracyclines -
  - May cause photosensitivity
  - Take oral dose with at least 8 oz fluids and food
  - Ca, Mg and iron should be consumed 2 hrs before taking meds or consumed 3 hrs after meds
- Macrolides -
  - Do not give with or immediately before or after juices
  - Discuss many drug interactions with pt
  - Report immediately: chest pain, palpitations, dizziness, jaundice, rash, hearing loss
- Aminoglycosides -
  - Ensure adequate hydration; encourage fluid intake up to 3L/day (unless contraindicated)
  - Dosage usually parenteral
  - Neomycin only oral form
  - Monitor renal function
  - Yogurt/buttermilk/probiotics to help prevent superinfection
  - Report: change in hearing, ringing in ears (tinnitus) or full feeling in ears
  - Report: N/V with motion, ataxia, nystagmus, dizziness
  - Ophthalmic: watch for redness, burning, itching of the eyes or redness of skin
  - Monitor IV sites for heat, swelling, redness, pain or red streaking over veins
- Quinolones -
  - Educate about photosensitivity
  - Instruct to take any antiacids, iron, zinc preps, multivitamins or sucralfate 1 hr before or after meds
  - Report: headache, dizziness, restlessness, diarrhea or vomiting, oral candidiasis, flushing of face; inflammation of the tendons



# Cardiovascular Medications

## Antihypertensives

### ACE Inhibitors

-pril

T. class: Antihypertensives  
P. class: ACE Inhibitors

#### Mechanism of Action:

- Inhibit ACE (angiotensin-converting enzyme)
- ACE is responsible for converting AI to angiotensin II
- Angiotensin II is a potent vasoconstrictor and also induces aldosterone secretion (stimulates sodium and water resorption); both increase BP



**Black Box Warning**  
Fetal toxicity; avoid in pregnancy

#### Indications:

- HTN, heart failure
- Diabetics with neuropathy

#### Contraindications:

- KDA (especially rxn of angioedema)
- Baseline K<sup>+</sup> level of 5 mEq/L or higher
- Pregnant or lactating women
- Children
- Pts with bilateral renal artery stenosis

#### Adverse effects:

- Fatigue, dizziness, mood changes, headaches
- Dry, nonproductive cough
- Loss of taste
- Hyperkalemia
- Angioedema
- Renal impairment or ARF

#### Interactions:

- Diuretics
- NSAIDs
- Lithium
- K<sup>+</sup> supplements and K<sup>+</sup>-sparing diuretics

- benazepril (Lotensin)
- captopril (Capoten)
- enalapril (Vasotec)
- fosinopril (Monopril)
- lisinopril (Prinivil or Zestril)
- moexipril (Univasc)
- perindopril (Aceon)
- quinapril (Accupril)
- ramipril (Altace)
- trandolapril (Mavik)

- Often used as 1st-line drugs in tx of heart failure and HTN
- Often combined as drug product with thiazide diuretic or a CCB
- Captopril - shortest 1/2 life; needs more frequent dose
- Captopril and lisinopril - not prodrugs therefore not activated in liver and good for pts w/liver dysfunction

#### Considerations

- Monitor serum K<sup>+</sup> and Na<sup>+</sup> levels
- Pt must not stop med abruptly due to potential for rebound HTN

- Monitor: BP, pulse, wt, I/Os
- Use caution in older pts and pts with renal dysfunction
- Contact HCP immediately if angioedema occurs

#### Patient Education

- Discuss possibility of impaired taste and to avoid K<sup>+</sup> supplements
- Will take several weeks to see full effects
- Inform pt about not stopping meds and potential for sexual dysfunction
- Instruct: monitor daily wts, BP and HR, avoid sudden changes in position; increase intake of fluids and fiber; low-fat diet, moderate exercise and ↓ stress

### Beta Blockers

-olol

T. class: Antihypertensives  
P. class: Beta blockers

#### Mechanism of Action:

- Block sympathetic nervous system stimulation by competing with epinephrine and norepinephrine
- Can be either cardioselective (beta1-blocking; targets receptors on heart) or nonspecific (blocks both beta1 and beta2-adrenergic receptors)



**Black Box Warning**  
Do not withdraw abruptly

#### Indications:

- Angina, MI, cardiac dysrhythmias
- HTN, heart failure

#### Contraindications:

- Uncompensated heart failure
- Cardiogenic shock, heart block or bradycardia
- Pregnancy
- Severe pulmonary disease; Raynaud's disease

#### Adverse effects:

- Bradycardia, AV block, impotence
- Constipation, N/V, fatigue, depression
- Delayed hypoglycemia recovery
- Major effects when abruptly stopped (precipitate an MI, rebound HTN)

#### Considerations

- Monitor: BP, pulse, wt, I/Os, blood glucose if diabetic
- Pulse: count apical for 1 full minute; BP: take supine and standing
- Pt must not stop med abruptly due to potential for rebound hypertension

#### Patient Education

- Inform pt about not stopping meds (see above) and potential for sexual dysfunction
- Instruct: monitor daily wts, BP and HR, avoid sudden changes in position; increase intake of fluids and fiber; low-fat diet, moderate exercise and ↓ stress
- Report to HCP: HR less than 60 bpm; BP <100 mm Hg systolic or <80 mm Hg diastolic or wt gain

#### Interactions:

- Antacids, anticholinergics
- Digoxin, diuretics
- Oral hypoglycemic drugs, insulin



# Cardiovascular Medications

## Antihypertensives

### ARBS (Angiotensin II Receptor Blockers)

-sartan

T. class: Antihypertensives  
P. class: ARBs

#### Mechanism of Action:

- Similar to ACE inhibitors: block the binding of Ang II to Type 1 Ang II receptors
- Block vasoconstriction and secretion of aldosterone
- Do not cause cough like ACE inhibitors

#### Indications:

- Heart failure
- HTN

#### Contraindications:

- Pregnant or lactating women
- Older patients
- Pts with renal dysfunction

#### Adverse effects:

- Chest pain, fatigue, weakness
- Hypoglycemia, diarrhea, anemia
- Urinary tract infection

#### Interactions:

- K<sup>+</sup> supplements and K<sup>+</sup>-sparing diuretics (can cause hyperkalemia)
- NSAIDs
- Lithium
- Rifampin

#### Black Box Warning

Fetal toxicity;  
avoid in pregnancy

#### Considerations

- Tolerated best with meals
- Monitor: BP, pulse, wt, I/Os
- Pulse: count apical for 1 full minute; BP: take supine and standing
- Pt must not stop med abruptly due to potential for rebound HTN

#### Patient Education

- Inform pt about not stopping meds abruptly and potential for sexual dysfunction
- Instruct: monitor daily wts, BP and HR, avoid sudden changes in position; increase intake of fluids and fiber; low-fat diet, moderate exercise and ↓ stress
- Report any unusual dyspnea, dizziness, excessive fatigue

### CCBs (Calcium Channel Blockers)

T. class: Antihypertensives  
P. class: Ca channel blockers

-dipine; -amil; -azem

#### Mechanism of Action:

- Prevent calcium from assisting in contraction of heart
- Smooth muscles relax and arteries dilate → increased blood flow to heart and decreased SVR

#### Indications:

- Angina, HTN
- Supraventricular tachycardia (as an antidysrhythmic)
- Coronary artery spasms
- Afib/flutter (short-term)
- Migraines; Raynaud's disease

#### Contraindications:

- Acute MI
- 2nd- or 3rd-degree AV block
- Hypotension

#### Adverse effects:

- Hypotension, palpitations
- Tachycardia or bradycardia
- Constipation, nausea
- Dyspnea, rash, flushing
- Peripheral edema

#### Interactions:

- Grapefruit juice
- Beta blockers
- Digoxin
- Azole antifungals
- Statins
- Clarithromycin
- Erythromycin
- HIV drugs
- Cyclosporine
- Amiodarone

#### Benzothiazepines

- diltiazem (Cardizem, Dilacor, Tiazac, Cartia XT, Matzim LA, Taztia XT, Diltia XT)\*

#### Phenylalkylamines

- verapamil (Calan, Isoptin, Verelan)\*

#### Dihydropyridines

- amlodipine (Norvasc)\*
- felodipine (Plendil)
- isradipine (DynaCirc)
- nicardipine (Cardene)\*
- nifedipine (Adalat, Procardia)\*
- nimodipine (Nimotop)

\*Used for tx of chronic stable angina

#### Considerations

- Monitor: BP, pulse, wt, I/Os, for edema and SOB
- Pulse: count apical for 1 full minute; BP: take supine and standing
- Pt must not stop med abruptly due to potential for rebound HTN
- If on nifedipine - follow admin orders carefully (esp. dosage) and closely monitor vitals
- Pay close attention if patient has history of: hypotension, palpitations, tachy/bradycardia, constipation, dyspnea, edema

#### Patient Education

- Inform pt about not stopping meds abruptly and potential for sexual dysfunction
- Instruct: monitor daily wts, BP and HR, avoid sudden changes in position; increase intake of fluids and fiber; low-fat diet, moderate exercise and ↓ stress
- Report any palpitations, pronounced dizziness, nausea, dyspnea



# Cardiovascular Medications

## Antihypertensives

### Vasodilators

T. class: Antihypertensives  
P. class: Vasodilators

#### Mechanism of Action:

- Act directly on arterioles and/or venous smooth muscle to cause relaxation and therefore vasodilation, leading to ↓ SVR



#### Black Box Warning

Nitroprusside:  
severe hypotension  
and cyanide toxicity

#### Indications:

- HTN

#### Contraindications:

- Hypotension, cerebral edema, head injury
- Acute MI, CAD
- Heart failure secondary to diastolic dysfunction

#### Adverse effects:

- Diazoxide: many undesirable effects and rarely used
- Hydralazine: dizziness, headache, anxiety, tachycardia, edema, dyspnea, N/V, diarrhea, hepatitis, SLE, Vit B6 deficiency, rash
- Minoxidil - T-wave EKG changes
- Nitroprusside - cyanide/thiocyanate toxicity

#### Interactions:

- Low incidence

### Considerations

- Baseline neurological assessment
- Caution with older patients (may have problems with hypotension, dizziness, syncope)
- Hydralazine - closely monitor pt for 10 - 80 minutes after injection; watch for s/s of SLE (systemic lupus erythematosus)
- Nitroprusside - dilute! close monitoring due to it being a potent vasodilator; never infuse for > 10 minutes; cyanide and thiocyanate toxicity seen when used for long pd at high rates
- Monitor: BP, pulse, wt, I/Os
- Pt must not stop med abruptly due to potential for rebound HTN

### Patient Education

- Inform pt about not stopping meds abruptly and potential for sexual dysfunction
- Instruct: monitor daily wts, BP and HR, avoid sudden changes in position; increase intake of fluids and fiber; low-fat diet, moderate exercise and ↓ stress
- Report any unusual photosensitivity, skin rashes, CNS changes

### Alpha<sub>1</sub> Blockers -amine, -osin

T. class: Antihypertensives  
P. class: Alpha blockers

#### Mechanism of Action:

- Interrupt stimulation of the SNS at the alpha-1 adrenergic receptors
  - By displacing norepinephrine (NE) or making receptors less receptive to NE
- Leads to arterial and venous dilation which reduces PVR and blood pressure

#### Indications:

- HTN
- Benign prostatic hyperplasia
- Vasoconstriction from Raynaud's disease or acrocyanosis
- Extravasation of vasopressors such as epinephrine (leaking out of blood vessels into surrounding tissue)

#### Contraindications:

- Peripheral vascular disease
- Hepatic and renal disease
- CAD, peptic ulcer, sepsis

#### Adverse effects:

- 1st-dose phenomenon: severe and sudden drop in BP after 1st dose
- Orthostatic hypotension
- Dizziness, headache, constipation
- Dry mouth, sexual dysfunction

### Considerations

- Monitor: BP, pulse, wt, I/Os
- Pulse: count apical for 1 full minute; BP: take supine and standing
- Be aware of potential for hypotension-induced dizziness & syncope
- Dry mouth - encourage water intake and use of OTC products for dry mouth
- Tamulosin - pts must inform all HCPs of use before any surgical procedure
- Pt must not stop med abruptly due to potential for rebound hypertension

### Patient Education

- Inform pt about dry mouth, tamulosin w/surgery, not stopping meds (see above) and potential for sexual dysfunction
- Instruct: monitor daily wts, BP and HR, avoid sudden changes in position; increase intake of fluids and fiber; low-fat diet, moderate exercise and ↓ stress
- Report to HCP: HR less than 60 bpm; BP <100 mm Hg systolic or <80 mm Hg diastolic or wt gain or fainting
- Anything leading to vasodilation must be avoided:
  - Alcohol intake, excessive exercise, hot climates, use of saunas, hot tubs

#### Interactions:

- Phentolamine - beta blockers and epinephrine
- Tamsulosin - warfarin, antihypertensives, erectile dysfunction meds, alcohol

- alfuzosin (Uroxatral)
- doxazosin (Cardura)
- phenoxybenzamine (Dibenzyline)
- phentolamine (Generic)
- prazosin (Minipress)
- terazosin (Hytrin)
- tamsulosin (Flomax)



# Cardiovascular Medications

Diuretics

## Loop Diuretics

T. class: Antihypertensives/Diuretics  
P. class: Loop diuretics -ide

- bumetanide (Bumex, Burinex)
- furosemide (Lasix)
- ethacrynic acid (Edecrin)
- torsemide (Demadex)

### Mechanism of Action:

- In loop of Henle: block Cl<sup>-</sup> and Na<sup>+</sup> resorption (leads to loss of fluid)
- Also help dilate blood vessels (↓ SVR)

### Indications:

- Edema associated with heart failure, hepatic or renal disease
- HTN
- Hypercalcemia (to ↑ renal excretion of Ca<sup>++</sup>)

### Contraindications:

- Hepatic coma
- Severe electrolyte loss

### Adverse effects:

- Dizziness, headaches, tinnitus, blurred vision
- N/V, diarrhea
- Torsemide: Agranulocytosis, thrombocytopenia, neutropenia
- Hypokalemia, hyperglycemia, hyperuricemia
- Furosemide: Erythema multiforme, photosensitivity

### Interactions:

- |                               |           |
|-------------------------------|-----------|
| • Aminoglycosides, vancomycin | • Lithium |
| • Corticosteroids, digoxin    | • NSAIDs  |
| • Antidiabetic drugs          |           |

### Black Box Warning

Furosemide: Severe water and electrolyte depletion

### Considerations

- Be aware with older patients and those with severe electrolyte loss and liver failure
- Watch drug interactions
- Monitor daily: BP & pulse rate (supine and standing), I/O, wt, hydration status, capillary refill
- Watch for: dizziness, fainting, light-headedness on changing position; weakness, fatigue, tremor, muscle cramps, changes in mental status; cold, clammy skin

### Patient Education

- ↑ fiber and fluids (to avoid constipation); take diuretic in A.M.
- Safety measures to prevent falls; change positions slowly
- Instruct on s/s of hypokalemia: anorexia, nausea, lethargy, muscle weakness, mental confusion, hypotension
- Avoid extreme sweating; keep journal of daily wts and dosage

## Potassium-Sparing Diuretics

T. class: Diuretics

P. class: Potassium-sparing diuretics

- amiloride (Midamor)

- spironolactone (Aldactone, CaroSpir)
- triamterene (Dyazide, Maxzide)

### Mechanism of Action:

- In collecting ducts and distal convoluted tubules: interfere with sodium-potassium exchange
- Spironolactone: Binds to aldosterone receptors and blocks resorption of sodium and water

### Indications:

- HTN, hyperaldosteronism
- To reverse K<sup>+</sup> loss by loop and thiazides
- Metabolic alkalosis, heart failure

### Contraindications:

- Hyperkalemia
- Severe renal failure or anuria
- Severe hepatic failure

### Adverse effects:

- Spironolactone: gynecomastia, amenorrhea, irregular menses
- Triamterene: decreased folic acid levels, kidney stones
- Hyperkalemia
- Dizziness, headache
- Cramps, N/V, diarrhea

### Interactions:

- |                  |                              |
|------------------|------------------------------|
| • Lithium        | • K <sup>+</sup> supplements |
| • ACE Inhibitors | • NSAIDS                     |

### Black Box Warning

Spironolactone: Tumorigenic with long-term use

### Considerations

- Monitor daily: BP & pulse rate (supine and standing), I/O, wt, hydration status
- Watch for: dizziness, fainting, light-headedness on changing position; weakness, fatigue, tremor, muscle cramps, changes in mental status; cold, clammy skin
- Watch for s/s of hyperkalemia: N/V, diarrhea

### Patient Education

- Educate on s/s of hyperkalemia
- Instruct on ↑ K<sup>+</sup> foods and to avoid overeating
- ↑ fiber and fluids (to avoid constipation); take diuretic in A.M.
- Safety measures to prevent falls; change positions slowly
- Avoid extreme sweating; keep journal of daily wts and dosage



# Cardiovascular Medications

## Diuretics & Digoxin

### Thiazides

-azide

T. class: Diuretics  
P. class: Thiazide diuretics

#### Mechanism of Action:

- In distal convoluted tubule: inhibit the resorption of  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^-$  leading to osmotic water loss
- Direct relaxation of arterioles leading to  $\downarrow \text{PVR}$

#### Indications:

- HTN; edema
- DI; idiopathic hypocalciuria
- Heart failure; hepatic cirrhosis

#### Contraindications:

- Hepatic coma
- Anuria
- Severe renal failure

#### Adverse effects:

- $\downarrow \text{K}^+$  and  $\text{Na}^+$  levels
- $\uparrow \text{Ca}^{++}$ , lipids, glucose, uric acid
- Dizziness, headache, blurred vision
- Anorexia, N/V, diarrhea
- Impotence, urticaria
- Jaundice, leukopenia

#### Interactions:

- Oral hypoglycemics
- Corticosteroids
- Digoxin
- Lithium
- NSAIDs

- HCTZ - hydrochlorothiazide (Microzide, Urozide)
- chlorothiazide (Diuril)
- chlorthalidone (generic)
- indapamide (Lozide)
- metolazone (Zaroxolyn)

- HCTZ - most commonly prescribed thiazide; often included in combo products

\*Thiazide-like diuretics\*

#### Considerations

- Monitor daily: BP & pulse rate (supine and standing), I/O, wt, hydration status
- Watch for: dizziness, fainting, light-headedness on changing position; weakness, fatigue, tremor, muscle cramps, changes in mental status; cold, clammy skin
- Watch for s/s of hypokalemia
- Monitor levels:  $\text{K}^-$ ,  $\text{Na}^+$ ,  $\text{Ca}^{++}$ , lipids, glucose, uric acid

#### Patient Education

- Educate on s/s of hypokalemia and hyperglycemia
- $\uparrow$  fiber and fluids (to avoid constipation); take diuretic in A.M.
- Safety measures to prevent falls; change positions slowly
- Avoid extreme sweating; keep journal of daily wts and dosage

## Cardiac Glycosides (Digitalis Glycosides)

#### Mechanism of Action:

- Inhibit Na-K ATP pump which causes  $\text{Na}^+$  &  $\text{Ca}^{++}$  concentration to  $\uparrow$  leading to enhanced myocardial contractility
- Increases diastolic filling between heart beats
- Decreases rate of electrical conduction (SA node to AV node)

#### Indications:

- Systolic heart failure
- Atrial fibrillation

#### Contraindications:

- 2nd- or 3rd-degree heart block
- Ventricular fibrillation
- Heart failure from diastolic dysfunction

#### Adverse effects:

- Bradycardia or tachycardia; hypotension
- Headache, fatigue, confusion, convulsions
- Unusual color vision (green/yellow); halo vision
- Anorexia, N/V, diarrhea

#### Interactions:

- Many! Most important:
- Amiodarone, quinidine, verapamil (will  $\uparrow$  digoxin levels by 50%)
- Large amounts of bran ingested
- Ginseng, hawthorn, licorice, St. John's wort

T. class: Inotropes  
P. class: Cardiac glycosides

- digoxin (Apo-Digoxin, Lanoxin, Lanoxin Pediatric, Toloxin)

- One of the oldest cardiac drugs
- Often used in conjunction with other meds
- Has a low therapeutic index

#### Considerations

- Before administration: assess serum electrolytes, especially  $\text{K}^+$  and  $\text{Mg}^{++}$  (low levels of each can lead to digoxin toxicity); apical pulse for 1 minute (hold dose if  $<60$  or  $>100$  bpm)
- Double-check dose!
- IV administration: infuse undiluted forms at around 0.25 mg/min or per protocol
- Oral administration: do NOT give with high fiber foods
- NOT recommended in intramuscular forms
- Incompatible with many other meds in solution or syringe
- After administration: monitor closely due to narrow range between therapeutic and toxic levels
  - Monitor: neuro changes, GI system, cardiac, visual
  - Frequently measure vitals, serum drug levels and serum  $\text{K}^+$
  - S/S of digoxin toxicity: headache, dizziness, confusion, nausea, visual disturbances (yellow/green/halo); EKG changes
- Antidote: digoxin immune Fab parenterally over 30 min or IV bolus



# Cardiovascular Medications

## Antidysrhythmics

### Antidysrhythmics

T. class: Varies, mostly Antiarrhythmics  
P. class: Varies

#### Mechanism of Action:

- Correct abnormal cardiac electrophysiologic function in many ways depending on drug:
  - Delay or accelerate repolarization
  - Increase or decrease action potential
  - Block SNS stimulation to heart and therefore the transmission of impulses
  - Inhibit Ca channels

#### Indications:

- Many cardiac dysrhythmias, including:
- Afib and atrial flutter, premature atrial or ventricular contractions, ventricular tachycardia
- WPW syndrome; long-QT syndrome

#### Contraindications:

- 2nd- or 3rd-degree AV block
- Bundle branch block
- Cardiogenic shock
- Sick sinus syndrome

#### Adverse effects:

- Hypersensitivity reactions
- N/V, diarrhea
- Dizziness, headache, blurred vision
- May produce new dysrhythmias (e.g. prolonged QT interval)

#### Interactions:

- Warfarin (esp. w/ amiodarone; must monitor INR if given both)
- Grapefruit juice
- Digoxin
- Statins



#### Black Box Warning

Many, depending on drug:  
↑ mortality, proarrhythmic effects, stroke

- quinidine (Quinidex)
- disopyramide (Norpace)
- procainamide (Pronestyl, Procan)
- lidocaine (Xylocaine, Xylocard)
- phenytoin (Dilantin)
- flecainide (Tambocor)
- propafenone (Rythmol)
- All beta blockers
- amiodarone (Nexterone, Pacerone)\*
- dronedarone (Multaq)\*
- sotalol (Betapace, Sorine)\*
- ibutilide (Convert)\*
- dofetilide (Tikosyn)\*
- verapamil (Calan, Isoptin, Verelan)
- diltiazem (Cardizem, Dilacor, Tiazac, Cartia XT, Matzin LA, Taztia XT, Diltia XT)
- digoxin ((Apo-Digoxin, Lanoxin, Lanoxin Pediatric, Toloxin)
- adenosine (Adenocard)

- Large group of meds classified according to where and how they affect cardiac cells
- \*Most widely used: amiodarone, dronedarone, sotalol, ibutilide, dofetilide

#### Considerations

- Monitor vitals, especially BP and pulse - notify HCP if <60 bpm
- Monitor EKG for prolonged QT interval
- Immediately report: angina, hypotension, lightheadedness, loss of appetite, tinnitus, diarrhea
- Lidocaine: MUST verify solution is for cardiac use; double- or triple-check dosage!
- Amiodarone: take with food, may experience photosensitivity
- Dofetilide: monitor EKG; report chest pain, nausea, diarrhea

#### Patient Education

- Oral meds better tolerated with food/fluids
- Take care changing positions
- Avoid excessive heat
- Do not stop meds abruptly
- Diet: ↑ fluid and fiber; ↓ caffeine
- Monitor: BP, pulse, wt gain
- Amiodarone: sunglasses to protect eyes; notify HCP of any skin changes (blue/gray/jaundice/rash)



# Cardiovascular Medications

## Anticoagulants

### Anticoagulants

T. class: Anticoagulants  
P. class: Varies

#### Mechanism of Action:

- Prevent formation of a clot or thrombus in the clotting cascade
- Warfarin - prevents vit K synthesis in GI tract which stops production of clotting factors

#### Indications:

- MI, unstable angina, afib, long period of immobilization

#### Contraindications:

- Acute bleeding process
- Pregnancy (warfarin)
- Indwelling epidural catheter (LMWHs)

#### Adverse effects:

- Bleeding
- Heparin: Heparin-induced thrombocytopenia (HIT)
- Warfarin: skin necrosis, 'purple toes' syndrome
- Anemia, dizziness, SOB, fever
- Lethargy, muscle pain

#### Interactions:

- Many with warfarin: acetaminophen, aspirin, NSAIDs, some antibiotics and antidysrhythmics, barbiturates, statins, etc
- Heparin: aspirin, NSAIDs, oral anticoagulants, antiplatelets



### Black Box Warning

Bleeding risk; avoid premature discontinuation; pregnancy (warfarin)

- heparin
- warfarin (Coumadin)
- LMWHs (low-molecular-weight heparins)
  - enoxaparin (Lovenox)
  - dalteparin (Fragmin)
- Selective factor Xa inhibitors
  - fondaparinux (Arixtra)
  - rivaroxaban (Xarelto)
  - apixaban (Eliquis)
  - edoxaban (Savaysa)
  - betrixaban (Bevyxxa)
- Direct thrombin inhibitors
  - human antithrombin III (Thrombate)
  - lepirudin (Refludan)
  - argatroban (Argatroban)
  - bivalirudin (Angiomax)
  - dabigatran (Pradaxa)

### Considerations

- For injection sites - avoid areas within 2 inches of any skin opening: wounds, incisions, etc
- Pregnancy - not recommended, but heparin preferred over warfarin
- Check for allergy to benzyl alcohol and sulfites
- Heparin not interchangeable with LMWHs and don't give together
- Warfarin - no dental procedures or surgery
- Monitor vitals, heart sounds, peripheral pulses, neurologic status
- Notify HCP - changes in pulse rate/rhythm, BP, LOC, unexplained restlessness (may be bleeding or hemorrhage)
- Heparin must be given subcutaneous or IV, NOT IM; must monitor daily clotting studies
- Antidotes:
  - Heparin or LMWHs: IV admin of protamine sulfate
  - Oral warfarin: Vit K
  - Factor Xa Inhibitors: Andexxa

### Patient Education

- Oral meds: take with food/fluids
- Recommended: wt control; smoking cessation; control BP, ↓ stress
- Take meds as prescribed
- Report: any bleeding, severe headache, blurred vision, vomiting blood, dizziness/fainting; fever; ↓ UO or dark; ringing in ears, edema, blurred vision
- If on warfarin: Monitor Vit K intake; keep same amount each day; avoid alcohol and cranberry juice
- Avoid: tight-fitting clothes, crossing legs, sitting for too long, sharp razors (as clot-preventive measures)



# Cardiovascular Medications

Antiplatelets & Thrombolytics

## Antiplatelets

T. class: Antiplatelet drugs  
P. class: Varies

### Mechanism of Action:

- Prevent platelet adhesion at the site of blood vessel injury

### Indications:

- Stroke prevention (aspirin)
- To decrease risk for thrombotic stroke and TIA
- Post-MI; acute unstable angina
- PVD; intermittent claudication

### Contraindications:

- Thrombocytopenia, active bleeding, leukemia
- Traumatic injury, GI ulcer, vit K deficiency
- Recent stroke

### Adverse effects:

- Drowsiness, dizziness, confusion, flushing, headache
- N/V, GI bleeding, chest pain, edema, ab pain
- Rash, pruritus
- Bradycardia, hypotension
- Thrombocytopenia, agranulocytosis, leukopenia, neutropenia

### Interactions:

- Dipyridamole - clopidogrel, aspirin, other NSAIDs
- Aspirin - steroids, nonaspirin NSAIDs, heparin

- aspirin
- dipyridamole (Persantine)
- clopidogrel (Plavix)
- prasugrel (Effient)
- ticagrelor (Brilinta)
- pentoxifylline (Trental)
- cilostazol (Pletal)
- vorapaxar (Zontivity)
- tirofiban (Aggrastat)
- eptifibatide (Integrilin)
- abciximab (ReoPro)



### Black Box Warning

Increased bleeding risk

### Considerations

- Withhold 5-7 days before patient undergoes surgery
- Aspirin - not for children and teenagers, in pt with bleeding disorder, pregnant or lactating women, patients with vit K deficiency or PUD
- Monitor for any bleeding: epistaxis, hematuria, hematemesis, excessive bruising, bleeding gums, blood in stools
- Monitor platelet count: Report if at or below 80,000 cells/mm<sup>3</sup>

### Patient Education

- Aspirin - take w/6-8 oz water and food; remain upright 30 min after
- Change positions slowly
- Report: unusual or excessive bleeding, severe headache, blurred vision, vomiting blood, dizziness, fever, rash

## Thrombolytic Drugs

-plase

T. class: Thrombolytics  
P. class: Varies

- alteplase (Activase)
- tenecteplase (TNKase)

### Mechanism of Action:

- Break down thrombi in the coronary arteries by activating the conversion of plasminogen to plasmin

### Indications:

- Presence of thrombus that interferes significantly with normal blood flow in the heart
- Acute MI, arterial thrombosis, DVT
- Occlusion of shunts or catheters, PE
- Acute ischemic stroke

### Contraindications:

- Concurrent use of other drugs that alter clotting

### Adverse effects:

- Internal, intracranial and superficial bleeding
- Hypersensitivity, anaphylactoid reactions
- N/V, hypotension
- May induce cardiac dysrhythmias

### Interactions:

- Concurrent use of anticoagulants or antiplatelet agents

### Considerations

- Do not use IM injections (due to risk of bleeding)
- Monitor: drainage, urine, stool, emesis, sputum, secretions for blood
- Monitor vitals, report tachycardia or ↓ in BP; also report decrease in hemoglobin or hematocrit
- Monitor INR, aPTT, platelet counts and fibrinogen levels no later than 2-3 hrs post-administration
- Report: bleeding from gums/mucous membranes, epistaxis, hematuria, blood in stool

### Patient Education

- Notify HCP if:
  - Pink, red or cloudy urine;
  - Black, tarry or red stools
  - Ab or chest pain, dizziness, severe headache



# Cardiovascular Medications

Antihyperlipidemics  
(Antilipemics)

## HMG-CoA Reductase Inhibitors (Statins)

-statin

### Mechanism of Action:

- Inhibit the enzyme HMG-CoA reductase (which is necessary for liver to produce cholesterol)
- This decreases rate of cholesterol production and reduces plasma concentrations of LDL cholesterol

### Indications:

- Hypercholesterolemia (esp ↑ LDL); first-line drug therapy

### Contraindications:

- Pregnancy
- Liver disease, elevation of liver enzymes

### Adverse effects:

- Ab pain, rash, headache - most common
- Elevated liver enzymes
- Myopathy (muscle pain) which may lead to rhabdomyolysis
- Dizziness, blurred vision, fatigue
- Constipation, diarrhea, nausea

### Interactions:

- Warfarin; gemfibrozil
- Erythromycin, azole antifungals, quinidine, verapamil
- Amiodarone, grapefruit juice
- HIV and hep C protease inhibitors
- Cyclosporine, clarithromycin, diltiazem, amlodipine

- lovastatin (Altopen)
- pravastatin (Pravachol)
- simvastatin (Zocor)
- atorvastatin (Lipitor)
- fluvastatin (Lescol)
- rosuvastatin (Crestor)
- pitavastatin (Livalo, Zypitamag)

T. class: Antilipemics

P. class: HMG-CoA Reductase Inhibitors

### Considerations

- Assess alcohol intake due to potential for liver damage
- Take with at least 6-8 oz water or with meals to ↓ gastric upset
- Monitor for s/s of rhabdomyolysis: muscle soreness, change in urine color, fever, N/V, malaise
- If lipid profile ordered, instruct pt to fast for 12-14 hrs prior
- Limit grapefruit juice to < 1 qt/day

### Patient Education

- Educate:
  - ↓ fat and ↓ cholesterol diet; moderate exercise
  - Weight loss if needed
  - Smoking and drinking cessation
- Report to HCP: any new symptoms, persistent GI upset, abnormal or unusual bleeding, muscle aches/pain

## Bile Acid Sequestrants

T. class: Antilipemics

P. class: Bile acid sequestrants

- cholestyramine (Prevalite)
- colestipol (Colestid)
- colesevelam (Welchol)

### Mechanism of Action:

- Bind bile and prevent resorption of the bile acids from the SI which causes bile acids to be excreted in stool
- Liver will then do 2 things:
  - Convert more cholesterol to bile acids
  - ↑ the number of LDL receptors on its surface which bind to circulating LDL and ↓ LDL in bloodstream

### Indications:

- Type II hyperlipoproteinemia
- Pruritus associated with partial biliary obstruction (cholestyramine)

### Contraindications:

- Biliary or bowel obstruction
- Phenylketonuria (PKU)

### Adverse effects:

- Constipation, heartburn, nausea, belching, bloating
- Headache, tinnitus, burnt odor of urine

### Interactions:

- All drugs must be taken at least 1 hr before or 4-6 hrs after administration of bile acid sequestrant
- High doses will decrease absorption of vitamins A, D, E and K

### Considerations

- Assess alcohol intake due to potential for liver damage
- Take with meals to avoid GI upset
- Increase fiber and water intake to avoid constipation
- If in powder form must be mixed thoroughly with food or fluids (4-6 oz dissolved for at least 1 minute); add water if still not dissolved
- NEVER take in dry form
- Note timing of drug in relation to other medications

### Patient Education

- Educate:
  - ↓ fat and ↓ cholesterol diet; moderate exercise
  - Weight loss if needed
  - Smoking and drinking cessation
- Report to HCP: any unusual symptoms
- Inform patient most adverse side effects disappear over time



# Cardiovascular Medications

Antihyperlipidemics  
(Antilipemics)

## Niacin (Nicotinic Acid)

T. class: Antilipemics  
P. class: B-complex vitamin

- niacin (Niacor, Niaspan)

### Mechanism of Action:

- Not 100% known
- Possibly: inhibits lipolysis in adipose tissue, reducing production of free fatty acids (FFAs)
- The liver normally uses FFAs to synthesize triglycerides
- ↓ TG → ↓ LDL concentrations

### Indications

- Hyperlipidemia

### Contraindications:

- Liver disease, peptic ulcer
- Any active hemorrhagic process
- Gout

### Adverse effects:

- GI distress
- Cutaneous flushing, pruritus
- Blurred vision, glucose intolerance, hepatotoxicity

### Interactions:

- HMG-CoA reductase inhibitors

### Considerations

- Assess alcohol intake due to potential for liver damage
- Take NSAID 30 minutes before niacin to minimize flushing
- Take with meals to ↓ GI distress

### Patient Education

- Educate:
  - ↓ fat and ↓ cholesterol diet; moderate exercise
  - Weight loss if needed
  - Smoking and drinking cessation
- Discuss side effect of flushing face and option of NSAID dose prior to taking med

## Fibric Acid Derivatives (Fibrates)

T. class: Antilipemics  
P. class: Fibric acid derivatives

- gemfibrozil (Lopid)
- fenofibrate (Fenoglide, Lipofen)

### Mechanism of Action:

- Activate lipoprotein lipase (enzyme responsible for the breakdown of cholesterol)
- Suppress release of FFAs from adipose tissue
- Inhibit synthesis of TG in liver
- Increase secretion of cholesterol into bile
- Also induce changes in blood coagulation

### Indications:

- Hyperlipidemia but not first-line

### Contraindications:

- Severe liver or kidney disease
- Cirrhosis
- Gallbladder disease

### Adverse effects:

- Ab discomfort, nausea, diarrhea
- Headache, blurred vision, rash
- ↑ risk for gallstones, hematuria, ↓ urine output
- Prolonged prothrombin time

### Considerations

- Assess alcohol intake due to potential for liver damage
- Monitor liver, kidney function tests and prothrombin time

### Patient Education

- Educate:
  - ↓ fat and ↓ cholesterol diet; moderate exercise
  - Weight loss if needed
  - Smoking and drinking cessation

### Interactions:

- Gemfibrozil will enhance oral anticoagulants; be careful with warfarin
- Statins (especially with gemfibrozil)
- Fenofibrate may raise blood level of ezetimibe (Zetia)



# Endocrine Medications

## Pituitary Drugs

### Mechanism of Action: vary per med

- Most augment the natural effects of the mimicked pituitary hormone
- Octreotide and bromocriptine inhibit the hormone

### Indications: vary per med

- Cosyntropin: used for diagnosis of adrenocortical insufficiency
- Somatropin, somatrem: tx of hypopituitary dwarfism; stimulate skeletal growth; for wasting associated with HIV infection
- Octreotide: to alleviate symptoms of carcinoid tumors
- Pergonal, clomiphene: increase chances of pregnancy
- Bromocriptine: inhibits lactogenesis
- Vasopressin/desmopressin: for pts with DI due to deficiency in endogenous ADH

### Contraindications: vary per med

- Pts with acute or chronic illness (e.g. migraines, epilepsy, asthma)

### Adverse effects: vary per med

- Headache; fatigue
- Hyperglycemia; hypothyroidism
- Nausea; vomiting; diarrhea; cramps
- Dyspnea; arthralgia; hypercalcioria
- Uterine cramping

### Interactions:

- Carbamazepine; lithium; alcohol; demeclocycline
- Cyclosporine; thioridazine; ciprofloxacin
- Glucocorticoids

## Considerations / Patient Education

- Octreotide:
  - Double-check route of administration
  - Patients must report abdominal distress
  - Monitor glucose levels
- Desmopressin:
  - Many forms of administration: oral, IV, intranasal, subcutaneous
  - Rotate sites (SubQ and IM)
  - If used in patients with DI, fluid intake may need to be adjusted
- Vasopressin:
  - Notify prescriber if elevated BP, fever, nausea, ab cramping worsen or persist
  - Nasal spray is to be given topically to the nasal membranes, not inhaled
- Educate on route of administration and ask for return demo
- Suggest keeping a journal with record of symptoms
- Nasal spray pump for intranasal forms of desmopressin:
  - Prime pump before first use or if left unused for 1 week (depress pump 4x)
  - One pump = 10 mcg
- Instruct parents on the potential for children to develop bone problems; be on lookout for limping or favoring limbs
- Pts with DI: water intake needs to be monitored

## Drug and Hormone Mimicked

### Anterior Pituitary:

- cosyntropin (Cortrosyn)
  - Adrenocorticotrophic hormone (ACTH)
- menotropins (Menopur, Pergonal)
  - Follicle-stimulating hormone (FSH)
- somatropin (Genotropin, Humatropin)
  - Growth hormone (GH)
- somatrem (Protropin)
  - Growth hormone (GH)
- octreotide (Sandostatin)
  - Growth hormone (GH)
- clomiphene (Clomid, Serophene)
  - Luteinizing hormone (LH)
- bromocriptine (Parlodel)
  - Prolactin
- thyrotropin (Thyrogen)
  - Thyroid-stimulating hormone (TSH)

### Posterior Pituitary:

- vasopressin (Vasopressin, Pitressin)
  - Antidiuretic hormone (ADH)
- desmopressin (DDAVP, Nocdurna)
  - Antidiuretic hormone (ADH)
- oxytocin (Pitocin)
  - Oxytocin



# Endocrine Medications

## Thyroid Drugs

### Mechanism of Action:

- Mimic endogenous thyroid hormones

### Indications:

- Hypothyroidism
- To diagnose hyperthyroidism (TSH-suppression test)
- Prevention or tx of goiters
- Replacement hormone therapy when thyroid removed

### Contraindications:

- Recent MI
- Adrenal insufficiency
- Hyperthyroidism

- Natural:
  - thyroid, dessicated (Armour Thyroid, Westhroid)
- Synthetic:
  - levothyroxine (T4) (Synthroid)
  - liothyronine (T3) (Cytomel, Triostat)
  - liotrix (combo of T4 & T3) (Thyrolar)

### Adverse effects: Usually from overdose

- Cardiac dysrhythmias (worst effect)
- Tachycardia; palpitations; angina; HTN
- Insomnia; tremors; headache; anxiety
- Nausea; diarrhea; cramps; wt loss; fever

### Interactions:

- Phenytin; fosphenytoin
- Cholestyramine; antacids; Ca salts; iron
- Estrogen; warfarin

## Antithyroid Drugs

### Mechanism of Action:

- Impede formation of thyroid hormone
- PTU also inhibits the conversion of T4 & T3
- Radioactive iodine destroys thyroid gland by ablation

- Thioamide derivatives:
  - methimazole
  - propylthiouracil (PTU)
- Radioactive iodine (iodine-131)
- Potassium iodide

### Indications:

- Hyperthyroidism
- Prevent surge in thyroid hormones after tx for hyperthyroidism or thyroid cancer

### Adverse effects:

- Liver and bone marrow toxicity (most serious)
- Drowsiness; headache; vertigo; nausea; vomiting, diarrhea
- Smoky urine; decreased UO
- Agranulocytosis; leukopenia; rash; myalgia; nephritis

### Contraindications:

- Pregnancy (controversial)
  - If necessary, PTU during 1st trimester then methimazole for remainder of pregnancy

### Interactions:

- Bone marrow suppressants
- Oral anticoagulants

## Considerations / Patient Education

- Thyroid Drugs:
  - Lifelong therapy is the norm
  - Take at same time every day to maintain blood levels
  - Take once daily, in morning on empty stomach at least 30 minutes before breakfast
  - Avoid taking within 4 hrs of: OTC preps with iodine, antacids, or vitamins/supplements with iron and/or Ca
  - Avoid iodized salt and iodine-rich foods
  - Brands of drugs cannot be interchanged!
  - Older adults - may require a decreased dosage
- Pts need to report: chest pain, weight loss, palpitations, tremors, sweating, SOB immediately
- PTU:
  - Take with meals to decrease GI upset
  - Take same time every day
  - Monitor liver function tests and CBC counts
  - Report immediately: fever, sore throat, mouth ulcers, skin eruptions
  - Educate on s/s of hypothyroidism: wt gain; loss of mental and physical stamina; hair loss; firm edema; yellow dullness of skin
- Iodine-rich foods:
  - Soybeans; tofu; turnips
  - High-iodine seafood; certain breads



# Endocrine Medications

## Corticosteroids

- Glucocorticoids available topical, systemic, inhaled, nasal
- Mineralcorticoids available systemic

- Two types:
  - Glucocorticoids
  - Mineralcorticoids

### Mechanism of Action:

- Mimic endogenous corticosteroids
- Aid in synthesis of certain proteins that exert specific effects (e.g. anti-inflammatory; immunosuppressive)

### Indications:

- Adrenocortical deficiency
- Adrenogenital syndrome
- Bacterial meningitis
- Cerebral edema
- Collagen diseases (e.g. lupus)
- Dermatologic diseases
- Endocrine disorders (e.g. thyroiditis)
- GI diseases (e.g. ulcerative colitis)
- Chronic respiratory illness (e.g. asthma)
- Hematologic disorders
- Ophthalmic disorders
- Organ transplantation
- Leukemias and lymphomas
- Nephrotic syndrome
- Rhinitis (nasal)
- Inflammation of eye, ear and skin (topical)

### Contraindications:

- Cataracts; glaucoma; PUD; mental health problems
- Fungal or bacterial infections; other serious infections
- Caution w/pts with DB; gastritis; reflux or ulcer disease; heart failure

### Interactions (systemically administered):

- Non-K<sup>+</sup> sparing diuretics; aspirin
- Anticholinesterase drugs; immunizing biologics
- Antidiabetic drugs; thyroid hormones
- Antifungal meds; barbiturates
- Hydantoins; warfarin; oral contraceptives

### Considerations / Patient Education

- Pediatric pts: growth suppression may occur; document baseline ht and wt
- Caution with older adults (more prone to adrenal suppression)
- Best time to administer: 6-9 a.m.
- Prednisone and fludrocortisone:
  - Give orally with snack or meal to help decrease GI upset
  - Tell pts to avoid alcohol, caffeine and aspirin (to avoid ulcerogenic effects)
  - Due to immune suppression, monitor for flu symptoms, sore throat and fever
- Avoid abrupt withdrawal of all systemic corticosteroids → may result in adrenal insufficiency (s/s: fatigue; n/v; hypotension)
- Intraarticular injections: avoid overuse; ice packs for up to 24 hrs after administration

- Glucocorticoids:
  - alclometasone (Aclovate-topical)
  - betamethasone (Uticort-topical; Celestone-systemic)
  - beclomethasone (Becloment-inhaled)
  - clobetasol (Clobex-topical)
  - cortisone (Cortone acetate-systemic)
  - dexamethasone (Decadron-systemic)
  - fluocinolone (Capex-topical)
  - flunisolide (Aerospan-inhaled)
  - fluticasone (Flovent-inhaled)
  - halobetasol (Bryhali-topical)
  - hydrocortisone (Cortef-systemic; Alacort-topical)
  - methylprednisolone (Medrol-systemic)
  - mometasone (Elocon-topical; Asmanex-inhaled)
  - prednisolone (Orapred-systemic; Prednisol-topical)
  - prednisone (Rayos-systemic)
  - triamcinolone (Aristocort-systemic; Dermasorb-topical)
- Mineralocorticoids:
  - fludrocortisone (Florinef Acetate-systemic)

### Adverse effects:

- Can effect all body systems
- Heart failure; edema; HTN
- Convulsions; headache; vertigo; nervousness
- Growth suppression; Cushing's syndrome
- Hyperglycemia; psychosis (both very common)
- Peptic ulcers; pancreatitis
- Fragile skin; petechiae
- Muscle weakness; osteoporosis
- Glaucoma; wt gain
- Long-term: moon face

- Nasal sprays: clear nasal passage first
- Inhalers: may lead to fungal infections; rinse with water after each use
  - Report: fungal infection; hoarseness; throat irritation; dry mouth
- Long-term use:
  - Be aware decreased wound healing may occur
  - Pts must avoid sick people due to ↓ immune system
  - Report: edema; SOB; joint pain; fever; mood swings
  - Characteristics: acne; buffalo hump; obesity of trunk area; moon face; thin extremities
  - Be careful to avoid falls due to risk for osteoporosis: take sufficient Vit D and calcium
- Missed dose: take as soon as remember unless close to next dose
- Report wt gain of 2 lb/24 hrs or 5 lb/week



# Endocrine Medications

## Diabetes Drugs

### Insulins

- Rapid-acting
- Short-acting
- Intermediate-acting
- Long-acting
- Fixed combo

#### Mechanism of Action:

- Function as substitute for endogenous hormone
- Restore pt ability to metabolize carbs, fats and proteins; to store glucose in the liver and to convert glycogen to fat stores

#### Indications:

- Type I or Type II diabetes as needed

#### Contraindications:

- Already hypoglycemic pt (must test BG prior to administration)

#### Adverse effects:

- Hypoglycemia from excessive insulin which could lead to brain damage, shock, death
- Wt gain (most common)
- Lipodystrophy at site of repeated injections; allergic reactions (rare)

#### Interactions:

- Corticosteroids
- Estrogen
- Diuretics
- Thyroid drugs
- Nonselective beta blockers
- Hypoglycemic drugs

All insulins are considered high-alert medications!

### Rapid-Acting

- insulin lispro (Humalog, Ademlog) - appears clear and colorless
- insulin aspart (NovoLog, Fiasp)
- insulin glulisine (Apidra)
- AfreZZa: inhaled

#### Insulin Lispro:

- Route: SubQ
- Onset of action: 15 minutes
- Peak: 1-2 hr
- Duration: 3-5 hr

### Intermediate-Acting

- insulin isophane suspension (AKA NPH insulin)
- Appears cloudy or opaque

#### NPH Insulin:

- Route: SubQ
- Onset of action: 1-2 hr
- Peak: 4-8 hr
- Duration: 10-18 hr

### Long-Acting

- insulin glargine (Lantus) -
    - Appears clear and colorless
    - AKA basal insulin
    - Provides a prolonged, consistent BG level
  - insulin detemir (Levemir)
  - insulin degludec (Tresiba)
  - insulin glargine (Basaglar)
- Detemir and glargine NOT interchangeable
- Degludec - ultra long-acting

#### Insulin glargine:

- Route: SubQ
- Onset of action: 1-2 hrs
- Peak: None
- Duration: 24 hrs

### Short-Acting

- regular insulin (Humulin R, Novolin R)
- Appears clear and colorless

#### Regular insulin:

- Route: SubQ
- Onset of action: 30-60 minutes
- Peak: 2.5 hr
- Duration: 6-10 hr

### Fixed-Combo

- Humulin 70/30
- Humulin 50/50
- Novolin 70/30
- Ryzodeg (insulin degludec/insulin aspart)
- Humalog Mix 75/25
- Humalog 50/50
- Novolog 70/30

- All contain one intermediate-acting type and either a rapid-acting or a short-acting



#### Black Box Warning

AfreZZa - may cause acute bronchospasms



# Endocrine Medications

## Diabetes Drugs, cont.

### Oral Diabetic Drugs

- Biguanide
- Sulfonylureas
- Glinides
- Glitazones

### Biguanide (Metformin)

#### Mechanism of Action:

- Decreases glucose production by liver
- Decreases intestinal absorption of glucose
- Improves insulin receptor sensitivity

#### Indications:

- Type II diabetes (especially newly diagnosed)
- Prediabetes

#### Contraindications:

- Renal disease or renal dysfunction; alcoholism
- Metabolic acidosis; hepatic disease; heart failure

#### Adverse effects:

- Ab bloating; nausea; cramping; feeling of fullness; diarrhea
- Metallic taste; hypoglycemia; low B12 levels
- Lactic acidosis (rare)

#### Interactions:

- Cimetidine
- Diuretics
- Corticosteroids
- Contrast media (discontinue day of test and 48 hrs post)

### Sulfonylureas

- Oldest group of oral DB drugs

- glipizide (Glucotrol)
- glyburide (Diabeta)
- glimepiride (Amaryl)

#### Mechanism of Action:

- Bind to specific receptors on beta cells in the pancreas to stimulate the release of insulin
- Decrease the secretion of glucagon
- Pt must have functioning beta cells in the pancreas

#### Indications:

- Type II diabetes (especially early stages)
- NOT for Type I

#### Contraindications:

- Hypoglycemia; ethanol use
- Advanced age; allergy to sulfonamide antibiotics

#### Adverse effects:

- Hypoglycemia; wt gain
- Skin rash; nausea; epigastric fullness; heartburn

#### Interactions:

- Beta blockers; cimetidine; erythromycin; fluconazole; sulfonamide abx; DPP4 inhibitors; garlic; ginger; ginseng; carbamazepine; phenobarbital; phenytoin; rifampin

### Glinides

- repaglinide (Prandin)
- nateglinide (Starlix)

#### Mechanism of Action:

- Increase insulin secretion from the pancreas
- Short duration of action than Sulfonylureas

#### Indications:

- Type II DB

#### Contraindications:

- Same as sulfonylureas

#### Adverse effects:

- Hypoglycemia; wt gain

#### Interactions:

- Same as sulfonylureas
- Do NOT combine with sulfonylureas

### Glitzones

- AKA thiazolidinediones
- AKA insulin-sensitizing drugs
- pioglitazone (Actos)

#### Mechanism of Action:

- Decreases insulin resistance by enhancing the sensitivity of insulin receptors
- Inhibits glucose and triglyceride production in liver
- Slow onset of activity

#### Indications:

- Type II DB

#### Contraindications:

- NY Heart Association Class III or IV heart failure
- Caution in pts w/liver or kidney disease



**Black Box Warning**  
May cause or exacerbate heart failure

#### Adverse effects:

- Heart failure; peripheral edema; wt gain
- Decreased bone density which increases risk for fractures

#### Interactions:

- Ketoconazole; erythromycin



# Endocrine Medications

## ➤ Diabetes Drugs, cont.

### Considerations / Patient Education

- Insulin:
  - Always check BG levels before administration to make sure pt is not hypoglycemic
  - Check for current meds that may interact, especially: corticosteroids, thyroid drugs, diuretics, salicylates
  - Take extra care with U-500 insulin orders
  - Afrezza: contraindications of smoking, chronic asthma and COPD; also has black box warning
  - Do NOT shake NPH and premixed insulin mixtures; instead roll between the hands (helps avoid air in syringes)
  - Administer insulin at room temp but refrigerate in warm or hot climate; never give cold and do not freeze
  - Keep insulin at room temperature up to 1 month; in refrigerator up to 3 months
  - Administer subq at 90 angle; IV administration in special situations and only regular insulin
  - Give freshly mixed insulin within 5 minutes
  - Administer with meals ready:
    - Rapid-acting 15 minutes before meals
    - Short-acting 30 minutes before meals
    - NPH 30-60 minutes before meals
    - Afrezza 20 minutes before meals
    - Combo products 15-30 minutes before meals
- Oral Diabetic Drugs:
  - Give at least 30 minutes before meals
  - Biguanides: older adults or malnourished pt may react adversely
  - Metformin:
    - No contrast media
    - Be on lookout for lactic acidosis:
      - Hyperventilation; cold, clammy skin; muscle pain; ab pain; dizziness; irregular heartbeat
  - Weigh daily to watch for edema
- If hypoglycemia occurs, have pt: take glucagon, eat glucose tablets or gel, corn syrup or honey or drink fruit juice
- If pt on NPO, check with prescriber for instructions on meds
- Education:
  - Encourage pt to wear medical alert bracelet
  - Instruct on rotation of sites: inject same site for 1 week, move ~1 inch and inject there for 1 week
  - Sites: front/back of thigh; outer area of upper arm; fatty area of abs (> 2 inches from umbilicus)
  - Stress glucose monitoring, exercise, foot care, dietary plan, weight control, A1C monitoring
  - Encourage nutritional consult
  - Instruct to avoid smoking and alcohol; do not skip meals
  - Educate on s/s of hypo and hyperglycemia and situations that affect BG: fever, illness, stress, ↑ activity/exercise, surgery, emotional distress
  - Report: yellow discoloration of skin, dark urine, fever, sore throat, weakness, unusual bleeding or bruising



# Female Sex Hormones

## Estrogens

### Mechanism of Action:

- Mimic endogenous hormones
- Effects such as: regulate production of FSH and LH; promote development of female secondary sex characteristics; initiation of menses

### Indications:

- Tx for menopausal symptoms (most common)
- Hypogonadism; atrophic vaginitis
- Oral contraception; uterine bleeding

### Contraindications:

- Estrogen-dependent cancer; pregnancy
- Undiagnosed abnormal vaginal bleeding
- Active thromboembolic disorder

### Adverse effects:

- Thromboembolic events
- Risk of certain cancers; CV disorders; dementia
- Nausea (most common); diarrhea; vomiting; photosensitivity
- HTN; edema; amenorrhea; chloasma

### Interactions:

- Oral anticoagulants; rifampin; TCAs
- St. John's wort; smoking

- conjugated estrogens (Premarin)
- esterified estrogens (Estratab)
- estradiol transdermal (Estraderm, Climara, Vivelle)
- estradiol cypionate (Depo-Estradiol, DepoGen)
- estradiol valerate (Delestrogen)
- ethinyl estradiol (Estinyl)
- estradiol vaginal dosage forms (Vagifem, Estrace Vaginal Cream)
- estrone (Estrone Aqueous)
- estropipate (Ogen, Ortho-Est)

## Progestins

### Mechanism of Action:

- Mimic endogenous hormones
- Effects such as: decreased endometrial proliferation; increase in basal body temp; thickening of vaginal mucosa; relaxation of uterine smooth muscle

### Indications:

- Functional uterine bleeding
- Amenorrhea
- Prevention of contraception
- PMS; female infertility

### Contraindications:

- Same as estrogens

### Adverse effects:

- Liver dysfunction
- Thromboembolic disorders
- Risk of certain cancers, CV disorders; dementia
- Nausea; vomiting; amenorrhea
- Bone density loss (Depo-Provera)

### Interactions:

- Benzodiazepines; voriconazole
- Barbiturates; carbamazepine
- Phenytoin; rifampin
- St. John's wort
- Antidiabetic drugs

- hydroxyprogesterone (Hylutin)
- levonorgestrel (Plan B)
- medroxyprogesterone (Provera, Depo-Provera)
- megestrol (Megace)
- norethindrone acetate (Aygestin)
- norgestrel (Ovrette, Ovral)
- progesterone (Prometrium)
- etonogestrel implant (Implanon)

### Black Box Warning

Estrogens and Progestins: risk for endometrial cancer, cardiovascular disorders, breast cancer and dementia  
Depo-Provera: risk for loss of bone density

## Considerations / Patient Education

- Estrogens:
  - Take same time every day with food
  - Estradiol patch: apply to lower abs (not breasts or chest)
  - Discuss black box warning risks
  - Closely monitor patients who smoke due to increased risk for thromboembolic events
- Report: HTN; edema; thromboembolism; migraines; depression; breakthrough bleeding; wt gain of 2 lbs/24 hrs or 5 lbs/week
- Hormones may increase sensitivity to sunlight
- Progestins
  - Be aware of potential for interaction with antidiabetic drugs
  - Depo-Provera: one IM injection every 3 months; give in deep muscle mass and rotate sites
  - Megestrol: given as appetite stimulant for anorexia and unexplained weight loss in AIDS patients



# Male Sex Hormones

## Androgens and others

### Mechanism of Action:

- Mimic endogenous hormones
- Effects such as: stimulate normal growth of male sex organs and development of male secondary sex characteristics
- Will cause the release of endogenous testosterone to be inhibited; may suppress sperm production and lead to infertility
- Proscar inhibits the conversion of testosterone
- Sildenafil relaxes muscle of penis to permit flow

### Indications:

- BPH; angioedema; male androgenetic alopecia
- Male hypogonadism; erectile dysfunction
- Postpubertal cryptorchidism
- Prostate cancer

### Contraindications:

- ED drugs: CV disorders; nitrates
- Finasteride: women and children

### Adverse effects:

- Androgenic steroids:
  - Fluid retention
  - Rare: peliosis of the liver; liver cancer
- ED drugs:
  - May decrease BP in pt w/CV disease taking nitrates
  - Headaches; flushing; dyspepsia
- Finasteride:
  - Loss of libido; loss of erection; ejaculatory dysfunction

- Natural testosterone
- Synthetic testosterone
- Synthetic anabolic steroids
- Androgen inhibitors
- Phosphodiesterase inhibitors

- Natural:
  - testosterone (Androderm)
- Synthetic:
  - methyltestosterone (Android)
  - fluoxymesterone (Halotestin)
- Synthetic anabolic steroids:
  - oxymetholone (Anadrol-50)
  - oxandrolone (oxandrin)
- Androgen inhibitors:
  - finasteride (Proscar)
  - dutasteride (Avodart)
- Phosphodiesterase inhibitors:
  - sildenafil (Viagra)
  - vardenafil (Levitra)
  - tadalafil (Cialis)

### Interactions:

- Oral anticoagulants; cyclosporine
- Nitrates with ED drugs
- Azole antifungal drugs
- Erythromycin; clarithromycin
- Propranolol; verapamil



### Black Box Warning

All testosterone drugs: thromboembolic disorders; be aware of secondary exposure to transdermal gel and solution

### Considerations / Patient Education

- Take testosterone at regular intervals
- Testoderm: apply to clean, dry, shaven scrotal skin
- Androderm patches: back, abdomen, upper arms or thighs and avoid bony areas and scrotum
- Androgel: apply to shoulders, arms, abdomen
- Finasteride: protect from sunlight; not to be handled by pregnant women; female healthcare workers must wear gloves when handling
- Sildenafil:
  - Take 1 hr before sexual activity
  - Do not take with nitrates; not effective without sexual stimulation and arousal
  - Report prolonged erection (longer than 4 hrs) immediately
- Do not discontinue testosterone abruptly



# Gastrointestinal Medications

## Antacids

Nonprescription salts made of aluminum, magnesium, calcium and/or sodium

P. class: Antacids  
(Aluminum-, Calcium-, or Magnesium-containing or combination)

- Mg Carbonate (Gaviscon liquid)
- Mg Hydroxide (Milk of Magnesia)
- Mg Oxide (Mag-Ox)
- Mg Trisilicate (Gaviscon tablets)
- Al Carbonate (Basaljel)
- Al hydroxide (Amphojel; AlternaGEL)
- Ca Carbonate (Tums; Maalox antacid caplets; extra strength Alkets antacid)
- Na bicarbonate (Alka-Seltzer)
- Na Citrate (Citra pH)
- Al hydroxide and Mg hydroxide (Maalox, Mylanta)

### Mechanism of Action:

- Neutralize gastric acidity
- Stimulate secretion of mucus, prostaglandins and bicarbonate from gastric glands

### Indications:

- Acute relief of symptoms of:
  - Peptic ulcer; gastritis
  - Gastric hyperacidity; heartburn

### Contraindications:

- Renal failure; electrolyte disturbances
- GI obstruction

### Adverse effects:

- Diarrhea (Mg preparations)
- Constipation (Al and Ca formulations)
- Kidney stones (Ca)
- Systemic alkalosis (w/any antacid)
- Rebound hyperacidity (Ca when stopped abruptly)
- Milk-alkali syndrome (Ca)

### Interactions:

- Antacids cause interactions by 4 methods:
  - Adsorption - reduces ability of other drugs to be absorbed
  - Chelation - chemical inactivation of other drugs
  - ↑ stomach pH - will cause ↑ absorption of basic drugs and ↓ absorption of acidic drugs
  - ↑ urinary pH - will cause ↑ excretion of acidic drugs and ↓ excretion of basic drugs
- Some affected drugs:
  - Benzodiazepines; sulfonylureas; valproic acid; allopurinol
  - Tetracycline; thyroid hormones; corticosteroids
  - Digoxin; histamine antagonists; phenytoin
  - Salicylates; quinolone antibiotics

## H2 Receptor Antagonists

- AKA H2RAs or H2 Receptor Blockers
- Most popular drug for acid-related disorders
- Available OTC

-tidine

T. class: Antivulcer drugs  
P. class: H2-receptor antagonists

- cimetidine (Tagamet)
- ranitidine (Zantac)
- famotidine (Pepcid)
- nizatidine (Axid, Tazac)

### Mechanism of Action:

- Block the H2 receptor of acid-producing parietal cells

### Indications:

- GERD; PUD; erosive esophagitis
- Upper GI tract bleeding
- Zollinger-Ellison syndrome

### Contraindications:

- Caution with liver and/or kidney dysfunction (may need to adjust dose)

### Adverse effects (Low incidence):

- Hypotension (with IV administration)
- Headache; lethargy
- Confusion/disorientation (older adults)
- Impotence/gynecomastia (cimetidine)
- ↑ prolactin secretion
- Thrombocytopenia (ranitidine and famotidine)

### Interactions:

- Cimetidine - theophylline, warfarin, lidocaine, phenytoin
- Any med that requires an acidic environment for gastric absorption (such as ketoconazole)
- Smoking



# Gastrointestinal Medications

## Proton Pump Inhibitors (PPIs)

T. class: Antiulcer drugs  
P. class: PPIs

- lansoprazole (Prevacid)
- omeprazole (Prilosec)
- rabeprazole (AcipHex)
- pantoprazole (Protonix)
- esomeprazole (Nexium)
- dexlansoprazole (Dexilant)

### Mechanism of Action:

- Bind to the proton pump which prevents hydrogen ions from moving into stomach
- May cause achlorhydria (without HCl acid)

### Indications:

- Erosive esophagitis
- Symptomatic GERD (that does not respond to H2RAs)
- Active duodenal ulcers (short-term tx)
- Active benign gastric ulcers (short-term tx)
- Gastric hypersecretory conditions
- NSAID-induced ulcers
- Stress ulcer prophylaxis

### Contraindications:

- None except known drug allergy

### Adverse effects (Low incidence):

- Achlorhydria which may lead to bacterial overgrowth, intestinal metaplasia or hip fracture
- Long-term use: osteoporosis; clostridium difficile infections; risk for fractures; pneumonia; depletion of Mg<sup>++</sup>

### Interactions:

- May increase serum levels of diazepam and phenytoin
- With warfarin - risk of bleeding
- Ketoconazole; ampicillin; iron salts; digoxin
- Clopidogrel with omeprazole
- Sucralfate
- Food (PPIs should be taken on empty stomach)

## Sucralfate (Carafate)

T. class: Antiulcer drugs  
P. class: GI Protectants or Antiflatulents

### Mechanism of Action:

- Mucosal protectant; acts locally by binding to surface of an ulcer
- Stimulates secretion of mucus and bicarbonate base

### Indications:

- Stress ulcers; esophageal erosions; PUD

### Contraindications:

- Known drug allergy

### Adverse effects:

- Nausea; constipation; dry mouth

### Interactions:

- Physical interference (must time admin)

## Simethicone (Mylicon)

### Mechanism of Action:

- Helps gas bubbles break into smaller bubbles to facilitate their expulsion

### Indications:

- Gastric or intestinal gas (flatulence)

### Contraindications:

- Known drug allergy

### Adverse effects:

- None

## Considerations / Patient Education

- Be aware of all meds pt is taking to determine any potential interactions
- Chewables - make sure to chew thoroughly
- Liquid - shake well before administration
- For GERD or hyperacidity:
  - Avoid black pepper, caffeine, alcohol, harsh spices and extremes in food temperature
- Antacids:
  - All meds must be taken 1-2 hrs before or after antacids
  - Quinolone antibiotics - must be taken 2 hrs before/after antacids (absorption will decrease by 50% if not followed)
  - Al-antacids and Mg-antacids will cancel each other's adverse side effects (switch to combo if pt experiences diarrhea or constipation)
  - Take with at least 8 oz water
- H2RAs:
  - IV administration: monitor BP for hypotension
  - Report bloody or black stools
- PPIs:
  - Make sure swallowing capabilities are sufficient due to size of pill
  - If pt has problems swallowing capsules, open and sprinkle over 1 TB applesauce and swallow immediately
- Sucralfate:
  - Requires multiple daily doses
  - Give other meds 2 hrs before sucralfate
  - Give 1 hr before meals and at bedtime



# Gastrointestinal Medications

## Antidiarrheals

### Mechanism of Action:

- Adsorbents:** coat walls of GI tract and bind bacteria or toxin → excrete via stool; used for mild cases
- Probiotics:** restore balance of normal flora; used for antibiotic-induced diarrhea
- Anticholinergics:** ↓ rhythmic contractions and smooth muscle tone of the GI tract; used for severe cases
- Opiates:** reduce bowel motility → decreases transit time and thus stool frequency; provides relief of rectal spasms; used for severe cases

### Indications:

- Diarrhea
- Any major acute GI condition

### Contraindications:

- Mostly minor and depends on drug
- Constipation; dark stools; urinary retention
- Headache; dizziness; confusion
- Anxiety; drowsiness; lethargy; N/V

### Adverse effects:

- **Adsorbents:** digoxin; quinidine; hypoglycemic drugs; warfarin; methotrexate; glipizide (with cholestyramine)
- **Anticholinergics:** antacids; amantadine; TCAs; MAOIs; opiates; antihistamines
- **Opiates:** CNS depressants; alcohol; opioids; sedative-hypnotics; antipsychotics

Pt with diarrhea associated with a bacterial or parasitic infection must not use antidiarrheal drugs (will cause organism to stay in body)

- Adsorbents
  - activated charcoal
  - aluminum hydroxide
  - bismuth subsalicylate
  - cholestyramine
  - polycarbophil
- Antimotility drugs
  - Anticholinergics
    - atropine
    - hyoscyamine
  - Opiates
    - opium tincture
    - paregoric
    - codeine
    - diphenoxylate
    - loperamide
- Probiotics
  - Lactobacillus acidophilus
  - Lactobacillus GG
  - Saccharomyces boulardii

### Considerations / Patient Education

- Report c/o ab pain/distention, bloody stools, hypoactivity to no bowel sounds; fever to HCP immediately
- Instruct pt to take exactly as prescribed and to monitor wt, fluid intake, diarrhea frequency and changes in bowel patterns
- Bismuth subsalicylate will turn stool black or gray; do not take with other salicylates
- Tablets: take with 6-8 oz water
- Diphenoxylate: if given with atropine watch for overuse: dry mouth, ab pain, tachycardia, blurred vision
- Diphenoxylate: if given with loperamide must provide lots of fluids; do not exceed maximum

## Drugs for Irritable Bowel Syndrome

### Alosetron:

- Mechanism of action: serotonin receptor antagonist
- Black Box Warning: serious GI adverse reactions may occur

### Rifaximin:

- Mechanism of action: antibiotic; alters bacteria in gut
- Well-tolerated

### Eluxadoline:

- Mechanism of action: mixed opioid receptor agonist; lessens bowel contractions
- Contraindications: biliary duct obstruction; alcohol abuse

- IBS with diarrhea (IBS-D)
  - alosetron (Lotronex)
  - rifaximin (Xifaxan)
  - eluxadoline (Viberzi)
- IBS with constipation (IBS-C)
  - lubiprostone (Amitiza)
  - linacatotide (Linzess)

### Lubiprostone:

- Mechanism of action: chloride channel activator
- Contraindications: bowel obstruction
- Adverse effects: nausea; diarrhea; ab pain

### Linacatotide:

- Contraindication: GI obstruction
- Adverse effects: diarrhea; ab pain; flatulence

### Considerations / Patient Education

- Alosetron:
  - Given twice daily
  - Pt must be provided FDA-approved medication guide
  - Drug must be discontinued after 4 weeks if no response
  - Discontinue immediately if constipated or signs of ischemic colitis
- All IBS drugs: use with caution due to side effects



# Gastrointestinal Medications

## Laxatives

- One of the most misused OTC meds
- Not to be used long-term except for the bulk-forming type

### Mechanism of Action:

- Bulk-forming: absorb water in intestines which increases bulk and distends bowel → bowel movement
- Emollient: water absorbed into stool and expands → bowel distention → bowel movement
- Stimulant: stimulates the nerves that innervate the intestine → peristalsis; also increases fluid in colon → increases bulk and softens stool
- Saline: increases osmotic pressure in SI by stopping water absorption → watery stool
- Hyperosmotic: increases fecal water content in LI
- Meds for OIC or bowel resection:
  - Peripherally acting mu-opioid receptor antagonists

### Indications:

- Constipation
- Removal of toxic substance from body
- Prep for colonic diagnostic procedure/surgery
- Relistor: for hospice pts w/opioid-induced constipation
- Entereg: after GI resection surgery
- Movantik: opioid-induced constipation

### Contraindications:

- Caution: acute surgical abdomen; appendicitis symptoms; fecal impaction; intestinal obstruction; undiagnosed abdominal pain

### Adverse effects (vary per med):

- Fluid disturbances
- Electrolyte imbalances
- Gas formation
- Skin rash
- Abdominal bloating
- Cramping, diarrhea
- Increased thirst

### Interactions:

- Bulk-forming: antibiotics; digoxin; salicylates; tetracyclines; warfarin
- Mineral oil: decreased absorption of fat-soluble vits
- Hyperosmotic: barbiturates; general anesthetics; opioids; antipsychotics
- Lactulose: oral antibiotics
- Stimulant: antibiotics; digoxin; nitrofurantoin; salicylates; tetracyclines; oral anticoagulants

- Bulk-forming
  - psyllium
  - methylcellulose
- Emollient
  - docusate salts
  - mineral oil
- Stimulant
  - senna
  - bisacodyl
- Saline
  - magnesium hydroxide
  - magnesium sulfate
  - magnesium citrate
- Hyperosmotic
  - polyethylene glycol
  - lactulose
  - sorbitol
  - glycerin
- Meds for opioid-induced constipation (OIC) or bowel resection surgery (not OTC)
  - methylnaltrexone (Relistor)
  - alvimopan (Entereg)
  - naloxegol (Movantik)

### Considerations / Patient Education

- Docusate salts, emollients and saline: caution in older patients
- Hyperosmotic: do not use in older patients
- Methylcellulose: mix thoroughly with 8 oz water and drink immediately (will start to congeal if left sitting)
- Docusate: take with 6 oz water and drink 6-8 additional glasses of water daily
- Bisacodyl: best on empty stomach; do not chew/crush tablets; do not take milk, antacids or juices with the dose or within 1 hr of taking med
- Suppository: lubricate suppository prior to insertion; encourage pt to lie on left side for 15-30 minutes after
- Mg-based: very potent; used only in certain situations
- Senna: take meds at least 1 hr apart; may take 6-12 hrs to see effects
- Educate pt on potential for abuse w/laxatives
- Inform pt to report any of the following: abdominal distention; firm/hard abdomen; ab pain; worsening or no improvement in symptoms; rectal bleeding; unrelieved constipation or diarrhea; fever; nausea; vomiting; dizziness; muscle weakness; muscle cramping



# Gastrointestinal Medications

## Antiemetics

- Chemoreceptor trigger zone (CTZ): part of brain involved in induction of nausea/vomiting

### Mechanism of Action:

- Anticholinergic: block ACh receptors to stop nausea-inducing signals to the CTZ and vomiting center
- Antihistamines: similar to anticholinergics but block H1 receptors
- Antidopaminergics: block dopamine receptors in the CTZ
- Neurokinin Blockers: enhance serotonin blockers and glucocorticoids to inhibit chemo-induced emesis
- Prokinetic drugs: block dopamine receptors in the CTZ
- Serotonin blockers: block serotonin receptors in the GI tract, CTZ and vomiting center
- THC: major psychoactive substance in marijuana: inhibitory effect on brain, causing alteration in mood and perception which relieves N/V

### Indications (vary per med):

- Nausea/vomiting (including N/V associated w/chemo)
- Motion sickness
- Intractable hiccups
- Nonproductive cough
- Delayed gastric emptying
- GERD

### Contraindications (vary per med):

- Glaucoma (scopolamine and antihistamines)
- Lactation; breast cancer
- Shock
- GI obstruction
- Coma; seizures

### Adverse effects (vary per med):

- Dizziness; drowsiness
- Tachycardia/bradycardia
- Blurred vision
- Dry mouth
- Urinary retention
- Orthostatic hypotension
- EPS
- Diarrhea

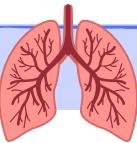
### Interactions:

- Anticholinergics: antihistamines and antidepressants
- Antihistamines: barbiturates; opioids; hypnotics; tricyclic antidepressants; alcohol
- Antidopaminergics: CNS depressants; alcohol
- Metoclopramide: anticholinergics and analgesics; alcohol
- Aprepitant: warfarin; oral contraceptives; azole antifungals; clarithromycin; diltiazem; nicardipine; protease inhibitors; verapamil; corticosteroids

- Anticholinergics (T. Class: Mydriatics)
  - scopolamine (Transderm-Scop, Scopace)
- Antihistamines (T. Class: Antihistamines)
  - meclizine (Antivert)
  - dimenhydrinate (Dramamine)
  - diphenhydramine (Benadryl)
  - hydroxyzine (Vistaril)
- Antidopaminergics (T. Class: Antiemetics)
  - prochlorperazine (Compazine)
  - promethazine (Phenergan)
- Neurokinin Blockers (T. Class Antiemetics)
  - aprepitant (Emend)
- Prokinetic Drugs (T. Class: GI Stimulants)
  - metoclopramide (Reglan)
- Serotonin Blockers (T. Class: Antiemetics)
  - dolasetron (Anzemet)
  - granisetron (Kytril)
  - ondansetron (Zofran)
  - palonosetron (Aloxi)
- Tetrahydrocannabinoid (THC)
  - dronabinol (Marinol)

### Considerations / Patient Education

- Diphenhydramine: cautiously administered via IV
- Meclizine: monitor BP often, especially if older pt
- Dry mouth alleviated with sugarless gum or hard candy
- Promethazine: check vitals and monitor for EPS; avoid alcohol and caffeine
- Metoclopramide: take 30 minutes before meals and at bedtime; watch for EPS (report immediately); long-term use associated with tardive dyskinesia
- Scopolamine: transdermal patch applied behind ear; rotate sites often
- Granisetron: IV or oral administration; temporary taste disorder may occur
- Dronabinol: change positions slowly
- Educate: inform pt about potential of drowsiness with antiemetic drugs; avoid taking with CNS depressants or alcohol



# Respiratory Medications

## Antihistamines

Directly compete with histamine for specific receptor sites

Histamines are involved in:

- Dilation of capillaries
- Contraction of smooth muscle
- Stimulation of gastric secretions
- Acceleration of heart rate

} H1 Receptors

} H2 Receptors

### Mechanism of Action:

- H1 Antagonists (H1 Blockers): compete with histamine for H1 receptors in smooth muscle surrounding blood vessels and bronchioles; commonly known as antihistamines
- H2 Antagonists (H2 Blockers): compete with histamine for H2 receptors; act on GI system

Antihistamines have antihistaminic, anticholinergic and sedative properties

T. Class: Antihistamines or anticholinergic antiemetics

### Indications:

- Management of nasal allergies, allergic rhinitis or urticaria
- Symptoms of the common cold; allergic reactions
- Motion sickness; vertigo
- Parkinson's disease (for anticholinergic effects); sleep aid

### Contraindications:

- Not to be used as sole drug therapy during acute asthmatic attacks
- Narrow-angle glaucoma; CHD; kidney dz; HTN; pregnancy
- Bronchial asthma; COPD; PUD; seizure disorders; BPH
- Fexofenadine: renal impairment
- Loratadine: not for <2 yrs
- Caution: impaired liver function/renal insufficiency; lactating mothers

### Adverse effects:

- Drowsiness
- Anticholinergic effects: dry mouth; changes in vision; difficulty urinating; constipation

Two types of antihistamines:

- Traditional: diphenhydramine, brompheniramine, chlorpheniramine, dimenhydrinate, meclizine, promethazine
  - Work both peripherally and centrally; have anticholinergic effects; less expensive; good for insomnia & motion sickness
- Nonsedating: Loratadine, cetirizine, desloratadine, fexofenadine
  - Developed to get rid of sedative effects
  - Work peripherally; longer duration of action; available OTC

### Interactions:

- Will interact with allergy test (stop all meds 4 days before test)
- Phenytoin; erythromycin
- Ketoconazole; cimetidine
- Alcohol; MAOIs; CNS depressants

## Decongestants

### Mechanism of Action:

- Adrenergics-constrict the small arterioles that supply the upper respiratory tract → ↓ nasal secretions
- Nasal steroids- decrease response of immune system to antigens

### Indications:

- Nasal congestion associated with acute or chronic rhinitis, common cold, sinusitis, hay fever or other allergies
- Swelling of nasal passages

### Contraindications:

- Adrenergics: narrow-angle glaucoma, uncontrolled CVD, HTN, DB, hyperthyroidism

3 groups:

- Adrenergics - sympathomimetics
- Anticholinergics - parasympatholytics
- Topical corticosteroids - intranasal steroids

Rebound congestion: when repeated use of inhaled decongestants leads to decreased therapeutic effect

### Adverse effects:

- Adrenergics- well-tolerated; nervousness, insomnia, palpitations, tremor
- Nasal steroids- mucosal irritation and dryness

### Interactions:

- Systemic sympathomimetic drugs and sympathomimetic nasal decongestants should not be given together
- MAOIs; methyldopa
- Urinary acidifiers and alkalinizers

### H1 Antagonists:

- diphenhydramine (Benadryl)
- brompheniramine (Bromfed)
- chlorpheniramine (generic)
- dimenhydrinate (Dramamine)
- meclizine (Antivert)
- promethazine (Phenergan)
- loratadine (Claritin)
- cetirizine (Zyrtec)
- desloratadine (Clarinex)
- fexofenadine (Allegra)

H2 Antagonists (see GI meds)

### Inhaled adrenergics:

- ephedrine (generic)
- oxymetazoline (Afrin)
- phenylephrine (Nasop, Sudafed)
- pseudoephedrine (Nexafed, Zephrex)
- tetrahydrozoline (Tyzine)

### Intranasal steroids:

- beclomethasone dipropionate (Beconase)
- budesonide (Rhinocort)
- flunisolide (Nasalide)
- fluticasone (Flonase)
- triamcinolone (Nasocort)
- ciclesonide (Omnaris)

### Intranasal anticholinergic:

- ipratropium (Atrovent)



# Respiratory Medications

## Antitussives

2 classes: opioid and nonopioid

### Mechanism of Action:

- Opioids: direct action on cough center in brain; provide analgesia; have drying effect on mucosa
- Nonopioids: dextromethorphan same MOA as opioids without analgesic properties or CNS depressant; benzonatate MOA numbs the stretch receptor cells in the respiratory tract

### Indications:

- Cough that is harmful and/or nonproductive

### Contraindications:

- Codeine and hydrocodone: alcohol use; CNS depression; anoxia; hypercapnia; respiratory depression; IIP; impaired renal function; liver disease; BPH; COPD
- Dextromethorphan: hyperthyroidism; advanced cardiac and vessel disease; HTN; glaucoma

Cough reflex - stimulated when receptors in the bronchi, alveoli, & pleura are stretched → signal sent to cough center in brain → cough

Codeine and hydrocodone are rarely used alone for cough; almost always in combo products



### Black Box Warning

Opioids are addictive and can depress respirations

- Opioid**
  - codeine (combo products: Tussar SF, Robitussin AC, others)
  - hydrocodone (combo products: Tussionex, others)
- Nonopioid**
  - dextromethorphan (Balminil DM, Benylin DM, Delsym, or combo products: Vicks Formula 44, Robitussin DM, others)
  - benzonatate (Tessalon Perles)

### T. Class: Antitussives

### Adverse effects:

- Codeine and hydrocodone: sedation, nausea, vomiting, lightheadedness, constipation
- Benzonatate: dizziness, headache, sedation, nausea, constipation, pruritus, nasal congestion
- Dextromethorphan: dizziness, drowsiness, nausea

### Interactions:

- Codeine and hydrocodone: other opioids, general anesthetics, tranquilizers, sedatives, hypnotics, TCAs, alcohol

## Expectorants

Expectoration: coughing up and spitting out  
Expectorants help remove excessive mucus that has accumulated in respiratory tract

- guaifenesin (Mucinex) most common

### T. Class: Expectorants

### Mechanism of Action:

- Increases the hydration of respiratory tract
- Maintains the sol layer necessary for ciliary clearance
- Reduces the viscosity of mucus

### Indications:

- Productive cough associated with common cold, bronchitis, laryngitis, pharyngitis, influenza, measles

### Contraindications:

- Known drug allergy

### Adverse effects:

- Nausea, vomiting, gastric irritation

### Interactions:

- None

## Considerations / Patient Education

- Be aware of all meds pt is taking to determine any potential interactions; take meds as directed
- Traditional antihistamines:
  - Caution in older adults (watch for dizziness, confusion, sedation, hypotension, irritability)
  - NOT to be used in acute asthma attack
  - Best tolerated with meals
  - Dry mouth: chew/suck hard candy or OTC throat lozenges
  - Do not take with other OTC or prescribed cough/cold meds
  - Monitor BP/vitals and for paradoxical rxns in older adults
- Nonsedating antihistamines: ↓ dose for elderly or ↓ renal fnx
- Antitussives:
  - May experience drowsiness/dizziness
  - Codeine - may depress breathing and respiration
  - Give at evenly spaced intervals; do NOT mix w/alcohol
- Decongestants:
  - Monitor BP and HR
  - ↑ fluid up to 3 L/day to help liquefy secretions
  - Excessive use of sprays/drops may lead to rebound congestion
- Report:
  - Difficulty breathing; palpitations, fever, tight chest, changes in sputum color, weakness and any other unusual adverse effects
- Expectorants: avoid alcohol and do not use for longer than 1 week



# Respiratory Medications

## Bronchodilators

Relax bronchial smooth muscle which causes dilation of the bronchi and bronchioles - 3 classes

3 classes:

- Beta-adrenergic agonists
- Anticholinergics
- Xanthine derivatives

## Beta-adrenergic agonists

- AKA sympathomimetic bronchodilators
- SABA used for acute/rescue asthma tx
- LABA never used for acute asthma tx
- Admin routes: oral, injectable, inhaled

### Mechanism of Action:

- Relax and dilate airways by stimulating the beta<sub>2</sub>-adrenergic (respiratory) receptors in the lungs

### Indications:

- Prevention or relief of bronchospasm
- Hypotension; shock

### Contraindications:

- Uncontrolled HTN or cardiac dysrhythmias
- ↑ risk for stroke

Categorized by onset of action:

#### • Short-acting beta agonist inhalers (SABA):

- albuterol (Proventil, Ventolin)
- ephedrine (generic)
- epinephrine (Adrenalin)
- levalbuterol (Xopenex)
- metaproterenol (Alupent, Metaprel)
- pirbuterol (Maxair)
- terbutaline (Brethine)

#### • Long-acting beta agonist inhalers (LABA):

- salmeterol (Serevent)
- formoterol (Foradil, Perforomist)
- arformoterol (Brovana)
- indacaterol (Arcapta Neohaler)
- vilanterol (Breo Ellipta; Anoro Ellipta)
- olodaterol (Striverdi Respimat)

### Adverse effects (varies per med):

T. Class: Bronchodilators

- Insomnia; restlessness; anorexia; cardiac stimulation; tremor
- Anginal pain; vascular headache
- HTN; hypotension

### Interactions:

- Nonselective beta blockers
- MAOIs
- Hypoglycemic drugs

## Anticholinergics

### Mechanism of Action:

- Block Ach receptors on the bronchial tree → prevents bronchoconstriction → airway relaxation and dilation occurs
- ↓ secretions in COPD pts

### Indications:

- Prevent bronchospasm associated w/COPD

- AKA long-acting muscarinic antagonists (LAMAs)

- ipratropium (Atrovent)
- tiotropium (Spiriva)
- aclidinium (Tudorza)
- umeclidinium (Incruse Ellipta)
- glycopyrrolate (Seebri)

### Contraindications:

- Known drug allergy (including to atropine)
- Caution: acute narrow-angle glaucoma and prostate enlargement

### Adverse effects:

- Dry mouth or throat; nasal congestion; heart palpitations
- GI distress; urinary retention; ↑ intraocular pressure
- Headache; coughing; anxiety

T. Class: Bronchodilators

## Xanthine Derivatives

### Mechanism of Action:

- Increase levels of cAMP which causes bronchodilation
- Stimulate CNS which enhances respiratory drive

### Indications:

- Asthma or COPD to dilate the airway
- To manage COPD
- Mild to moderate cases of asthma (not acute asthma attack)

- Not used much due to interactions and varying therapeutic levels

### Contraindications:

- Uncontrolled cardiac dysrhythmias; seizure disorders
- Hyperthyroidism; peptic ulcers

### Adverse effects:

- N/V; anorexia; sinus tachycardia
- Extra systole; palpitations
- Ventricular dysrhythmias; hyperglycemia

T. Class: Methylxanthines

- theophylline (Theolair, Slo-Bid)
- aminophylline (Phyllocontin, Truphylline)
- dyphylline (Lufyllin, Dyliz)

### Interactions:

- Allupurinol; cimetidine; macrolide antibiotics; quinolones; influenza vaccines; oral contraceptives; sympathomimetics; rifampin; St. John's wort; cigarette smoking
- Foods: charcoal-broiled, high-protein and low-carbohydrate



# Respiratory Medications

## NonBronchodilating

— Include leukotriene receptor antagonists and corticosteroids

### Leukotriene Receptor Antagonists

#### Mechanism of Action:

- Zileuton: Inhibits enzyme 5-lipoxygenase, necessary for leukotriene synthesis
- Montelukast and zafirlukast: Bind to the D4 leukotriene receptors in the respiratory tract tissues and organs

#### Indications:

- Prophylaxis and long-term tx and prevention of asthma
- Montelukast - allergic rhinitis
- NOT for acute asthma attacks

In asthma, leukotrienes cause inflammation, bronchoconstriction, and mucus production which leads to coughing, wheezing, and SOB

- montelukast (Singulair)
- zafirlukast (Accolate)
- zileuton (Zyflo)

T. Class: Leukotriene Modifiers

#### Contraindications:

- Allergy to povidone, lactose, titanium dioxide or cellulose derivatives

#### Adverse effects:

- Headache; nausea; dizziness; insomnia; diarrhea

#### Interactions:

- Phenobarbital; rifampin; aspirin; erythromycin; warfarin; propranolol; theophylline

## Corticosteroids

— AKA glucocorticoids

#### Mechanism of Action:

- Stabilize membranes of WBCs to decrease release of inflammatory substances
- Enhance activity of beta agonists (e.g. albuterol)

#### Indications:

- Persistent asthma (Inhaled)
- Severe or acute asthma (Systemic)

#### Contraindications:

- Inhaled - hypersensitivity to glucocorticoids; sputum + for Candida organisms; systemic fungal infection

#### Adverse effects:

- Inhaled - pharyngeal irritation, coughing, dry mouth, oral fungal infections (must rinse after use)
- High-dose IV or oral administration - adrenocortical insufficiency; ↑ susceptibility to infection; fluid and electrolyte disturbances; effects to CNS, endocrine system and connective tissues (Cushing's syndrome) → MUST taper slowly due to risk of adrenal suppression - Addisonian crisis

#### Systemic

- prednisone (Prednisone Intensol, Rayos)
- methylprednisolone (Medrol - oral, Solu-Medrol - IV)

#### Interactions:

- Antidiabetic drugs
- Cyclosporine; tacrolimus
- Itraconazole
- Phenytoin
- Phenobarbital
- Rifampin
- HCTZ and furosemide

#### Inhaled

- beclomethasone dipropionate (Beclavent)
- budesonide (Pulmicort Turbuhaler)
- ciclesonide (Omnaris)
- flunisolide (AeroBid)
- fluticasone (Flovent)
- mometasone (Asmanex)
- triamcinolone acetonide (Azmacort)

T. Class: Corticosteroids



# Respiratory Medications

## Considerations / Patient Education

- All respiratory drugs:
  - Take as prescribed and by prescribed route
  - Increase fluid intake unless contraindicated
  - Pts with asthma, bronchitis, COPD - avoid situations that lead to worsening symptoms (allergens, stress, smoking, etc)
- Bronchodilators:
  - Demonstrate proper method for administering inhaled form and allow time for return demo
  - Metered Dose Inhaler (MDIs) - wait 1-2 minutes between puffs; wait 2-5 minutes between 2 different inhaled meds
  - Spacer device: helps increase amount delivered
  - Dry Powder Inhaler (DPIs) - deliver dry micronized powder with each breath
  - Nebulizer - delivers droplets via small mouthpiece or mask
- Beta agonists:
  - Overdosage may be life-threatening
  - LABA - Not for acute tx
  - Take with food to decrease GI upset
  - Do not crush or chew oral sustained-release tablets
  - Instruct on epipen as needed
  - Assess respiratory status, breath sounds and pulse oximeter readings before, during and after therapy
- Anticholinergics:
  - Wait 1-2 minutes before second dose
  - Rinse mouth with water immediately after inhaled or nebulizer drug
  - Ipratropium - used prophylactically
    - Confirm no allergy to soybeans/peanuts/legumes
    - Encourage extra fluids
- Xanthine Derivatives:
  - Oral - take with food
  - Suppository forms need to be refrigerated
  - No smoking
  - Foods - avoid charcoal-broiled, high-protein, low carbs
  - Take meds round-the-clock
  - Report worsening adverse effects immediately
- LTRAs:
  - Montelukast - contains aspartame and phenylamine
  - Take on continuous schedule even if symptoms improve
  - Take montelukast at night
- Corticosteroids:
  - Inhaled -
    - Take every day, regardless of how s/he feels
    - Often taken with bronchodilator inhaled drug - take 2-5 minutes before corticosteroid
    - Keep inhalers and nebulizers clean; change filters
    - Encourage peak flow meter and journaling
    - Oral hygiene after last inhalation - rinse with water to prevent oral fungal infections
    - Prime before first use or if not used within 10 days
    - Do not wash inhaler or get wet
    - Discard by date on inhaler
  - Systemic -
    - Warn about Cushing's syndrome from excess levels
    - Do NOT abruptly discontinue (Addisonian crisis)



# Psychotropic Drugs



## Antianxiety and Hypnotic Drugs

### Mechanism of Action

- Increase the effectiveness of GABA (major calming neurotransmitter in the CNS)

- Benzodiazepines (most common)
- Z-hypnotics
- Doxepin
- Melatonin Receptor Agonists
- Suvorexant
- Buspirone



### Black Box Warning

Avoid using w/o opioids when possible; doxepin: not for children

#### Benzodiazepines

-pam; -lam

- diazepam (Valium)
- clonazepam (Klonopin)
- alprazolam (Xanax)
- lorazepam (Ativan)
- flurazepam (Dalmane)
- temazepam (Restoril)
- triazolam (Halcion)
- estazolam (ProSom)
- quazepam (Doral)

- Produce a calming effect
- Cause sedation at higher doses
- Quick onset of action
- High potential for dependence

T. Class =  
Anxiolytics or  
Hypnotics

### Indications:

- Sedation; relief of agitation or anxiety
- Alcohol withdrawal; insomnia

### Contraindications:

- Elderly due to risk for falls/bone fractures
- Those w/substance abuse disorders
- Pregnant or breastfeeding women

### Adverse effects:

- Ataxia; sedation; decreased cognitive function

### Interactions:

- Many: alcohol, opioids, TCAs, among others

#### Doxepin

- doxepin (Silenor)

T. Class =  
Antidepressants

### Indications:

- Insomnia (specifically difficulty maintaining sleep)

### Contraindications:

- Severe urinary retention; MAOIs; other CNS depressants; sedating antihistamines

### Adverse Effects:

- Drowsiness, dizziness, seizures, ataxia, hypoglycemia

### Interactions:

- Barbiturates, CNS depressants, quinolones, clonidine, evening primrose oil, MAOIs, alcohol

- Benzodiazepines (most common)
- Z-hypnotics

- Doxepin
- Melatonin Receptor Agonists

- Suvorexant
- Buspirone

### Black Box Warning

Avoid using w/o opioids when possible; doxepin: not for children

#### Z-Hypnotics

T. Class =  
Hypnotics

- zolpidem (Ambien)
- zaleplon (Sonata)
- eszopiclone (Lunesta)

- Sedative effect w/o antianxiety, anticonvulsant, muscle relaxant effects
- Faster onset than benzodiazepines
- Short half-lives

### Indications:

- Sedation, insomnia

### Contraindications:

- Angioedema; elderly; depression

### Adverse effects:

- Sleepwalking; ataxia; lethargy; headache; amnesia

### Interactions:

- CNS depressants; opioids

#### Melatonin Receptor Agonists

T. Class =  
Hypnotics

- ramelteon (Rozerem)

- Melatonin - naturally occurring hormone only excreted at night
- NOT classified as a scheduled substance

### Indications:

- Insomnia (specifically trouble falling asleep)

### Contraindications:

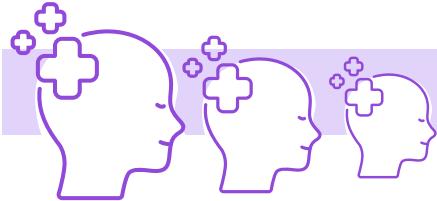
- Severe hepatic impairment
- Severe sleep apnea or severe COPD
- Patient taking fluvoxamine

### Adverse effects:

- Headache, dizziness; depression
- Long-term: high levels of prolactin and sexual dysfunction

### Interactions:

- CNS depressants, donepezil, opioids, alcohol



# Psychotropic Drugs



## Antianxiety and Hypnotic Drugs, cont.

### Suvorexant

- suvorexant (Belsomra)

T. Class =  
Hypnotics

- Acts as an orexin receptor antagonist
- Orexin - neuropeptide that promotes normal wakefulness

#### Indications:

- Insomnia

#### Contraindications:

- Narcolepsy; severe hepatic impairment
- Obstructive sleep apnea; severe COPD

#### Adverse effects:

- Daytime impairment, worsening depression
- Abnormal thinking/behavior
- ↑ suicidal ideation; sleep paralysis

#### Interactions:

- CNS depressants

### Buspirone

- buspirone (BuSpar)

T. Class =  
Anxiolytics

- Decreases anxiety without strong sedative-hypnotic properties; tolerated better than benzodiazepines
- Not a CNS depressant

#### Indications:

- Anxiety

#### Contraindications:

- Within 14 days of MAO inhibitor therapy
- Severe renal or hepatic impairment

#### Adverse effects:

- Dizziness; insomnia; nervousness
- Headache; depression

#### Interactions:

- Azole antifungals; grapefruit juice; alcohol
- CNS depressants; MAO Inhibitors

### Considerations / Patient Education

- Benzodiazepines: monitor for side effects and note that paradoxical reactions may occur (exact opposite of intended response); educate on risk of dependence
- Buspar: 2-4 weeks to see full effects
- Do not handle heavy equipment or drive until pt knows how he/she reacts

- Avoid alcohol and other antianxiety drugs; avoid caffeine
- Take meds with meals to avoid any GI upset; except Rozerem and Silenor
- All hypnotics: take before bedtime
- Doxepin: dilute with 4 oz fluids (not carbonated) and avoid direct sunlight

### Antidepressant Drugs

T. Class =  
Antidepressants

#### Mechanism of Action

- Possible MOA is an increase in serotonin, norepinephrine and dopamine

- SSRIs

- NaSSAs

- Serotonin Modulator

- SARIs

- NDRIs

- SNRIs

- TCAs

- MAOIs



#### Black Box Warning

May increase risk of suicidal thoughts in children & young adults

### SSRIs - Selective Serotonin Reuptake Inhibitors

- Fluoxetine (Prozac)
- Sertraline (Zoloft)
- Paroxetine (Paxil)
- Citalopram (Celexa)
- Escitalopram (Lexapro)
- Fluvoxamine (Luvox)

- Block the reuptake of serotonin making more of it available

#### Indications:

- Depression

#### Contraindications:

- Within 14 days of stopping MAO inhibitor
- Thioridazine or mesoridazine

#### Adverse effects:

- Sexual dysfunction; N/V; serotonin syndrome (see next page)

#### Interactions:

- Many! Antipsychotics, antiemetics, TCAs, lithium, MAOIs, St. John's wort



# Psychotropic Drugs

## Antidepressant Drugs, cont.



### NaSSAs

- mirtazapine (Remeron)

- Norepinephrine & Serotonin Specific Antidepressant
- Antagonize (block) adrenergic autoreceptors
- Minimal sexual dysfunction and improved sleep

#### Indications:

- Depression; anxiety

#### Contraindications

- Within 14 days of stopping MAO inhibitor

#### Adverse effects:

- Sedation, appetite stimulation, weight gain

#### Interactions:

- Diazepam, other CNS depressants; St. John's wort; alcohol

### Serotonin Modulator & Stimulator

- vortioxetine (Trintellix)

- May help geriatric pts increase cognitive deficits

#### Indications:

- Depression

#### Contraindications:

- Family history of bipolar disorder
- Pts taking diuretics (caution)

#### Adverse effects:

- Constipation; N/V; pruritus; hyponatremia; hypomania/mania (rare)

#### Interactions:

- NSAIDs, warfarin, diuretics, MAO inhibitors
- St. John's wort, alcohol

### SARIs

- nefazodone (formerly Serzone)
- trazodone (Oleptro - formerly Desyrel)
- brexpiprazole (Rexulti)

- Serotonin Antagonist and Reuptake Inhibitors

#### Indications:

- Depression
- Brexipiprazole - depression from schizophrenia

#### Contraindications:

- Nefazodone - Pre-existing liver problems
- Brexipiprazole - Elderly pts w/dementia-related psychosis ( $\uparrow$  risk of death)

#### Adverse effects:

- Sedation, headache, dizziness, orthostatic hypotension; priapism (prolonged erection)
- Dry mouth, blurred vision; akathisia, wt gain

#### Interactions:

- Anticholinergics; CNS depressants
- Amphetamines; antipsychotics
- St. John's wort, grapefruit juice

### Serotonin Syndrome

- Rare but life-threatening event
- Due to over-activation of serotonin receptors from too high a dose or interaction with other drugs (usually MAOI)
- S/S: ab pain, diarrhea, sweating, fever, tachycardia, elevated BP, delirium, muscle spasms, irritability, mood change
- Pt must discontinue all SSRIs for 2-5 weeks before starting MAOI

### NDRIs

- bupropion (Wellbutrin and Zyban)

- Norepinephrine Dopamine Reuptake Inhibitor
- Does not cause sexual dysfunction side effects

#### Indications:

- Wellbutrin - Depression
- Zyban - smoking cessation

#### Contraindications:

- Seizure disorder
- Bulimia or anorexia nervosa (past or present)
- Pt in midst of abrupt cessation of alcohol or sedatives

#### Adverse effects:

- Insomnia, tremor, anorexia, wt loss

#### Interactions:

- Amantadine, levodopa
- Other antidepressants
- Beta blockers
- MAO inhibitors
- Alcohol



# Psychotropic Drugs



## Antidepressant Drugs, cont.

### TCAs - Tricyclic Antidepressants

- amitriptyline (Elavil)
- clomipramine (Anafranil)
- imipramine (Tofranil)
- trimipramine (Surmontil)
- amoxapine (Amoxapine Tablets)
- desipramine (Norpramin)
- nortriptyline (Pamelor, Aventyl)
- protriptyline (Vivactil)

- Widely used before SSRIs; no longer considered first-line
- Have more side effects than SSRIs; take longer to reach optimal level; far more lethal in overdose

#### Indications:

- Insomnia; neuropathic pain syndromes

#### Contraindications:

- Within 14 days of stopping MAO inhibitor
- Pregnancy; recent MI; history of seizures

#### Adverse effects:

- Constipation, urinary retention; drowsiness; dry mouth; dysrhythmias

#### Interactions:

- Many! Barbiturates, CNS depressants, MAOIs

### Considerations / Patient Education

- Discuss:
  - All side effects of each medication; instruct on what to look for and when to call HCP
  - Potential for ↓ libido
  - All potential drug and lifestyle (e.g. alcohol) interactions
  - Need to take medication exactly as prescribed and do not stop abruptly
  - May not see full effect for several weeks
  - Take care when driving and operating large machinery
- MAOIs: provide list of foods to avoid and review s/s of hypertensive crisis
- Review s/s of serotonin syndrome

### Hypertensive Crisis

- Usually occurs w/in 15-90 minutes of ingesting problematic food
- Early s/s: Irritability, anxiety, flushing, sweating, severe headache; BP > 180/110
- Later s/s: anxious, restless, fever which becomes severe, followed by seizures and coma or death

### SNRIs

- venlafaxine (Effexor)
- desvenlafaxine (Pristiq)
- duloxetine (Cymbalta)

- Serotonin Norepinephrine Reuptake Inhibitors
- May have therapeutic effects on neuropathic pain
- Desvenlafaxine - primary active metabolite of venlafaxine (therefore similar effects)

#### Indications:

- Depression; GAD

#### Contraindications:

- Within 14 days of stopping MAO inhibitor

#### Adverse effects:

- Insomnia; anxiety; fatigue; GI bleeding; wt loss; hypertension, tachycardia

#### Interactions:

- NSAIDs, warfarin, alcohol use, anticoagulants, MAO inhibitors

### MAOIs - Monoamine Oxidase Inhibitors

- |                           |                             |
|---------------------------|-----------------------------|
| • isocarboxazid (Marplan) | • selegiline (EMSAM)        |
| • phenelzine (Nardil)     | • tranylcypromine (Parnate) |

- Monoamines- include norepinephrine, epinephrine, dopamine, serotonin, tyramine (in food)
- MAO- enzyme that destroys monoamines
- MAOIs - inhibit action of MAO
- Problem: Liver uses MAO enzymes to degrade monoamines in food, especially tyramine
- Tyramine can produce significant vasoconstriction → ↑ BP and threat of hypertensive crisis
- Pt taking MAOIs at risk of monoamine toxicity and hypertensive crisis especially when combined w/certain drugs and foods

#### Indications:

- Parkinson's disease; unconventional depression

#### Contraindications:

- HTN; CHF; Liver dz; recurrent headaches

#### Adverse effects:

- Orthostatic HTN, wt gain, edema; sexual dysfxn

#### Interactions:

- SSRIs; meperidine



# Psychotropic Drugs



## Mood Stabilizers

### Lithium

- lithium (Eskalith, Lithobid)

T. Class = Antimanics

- By altering electrical activity, lithium is a threat to all body functions regulated by electrical currents
- Has low therapeutic index: must monitor blood levels on a regular basis

**Mechanism of Action:** unknown, possibly:

- Helps stabilize electrical activity in neurons
- Reduces excitatory neurotransmitter glutamate

**Indications:**

- Bipolar (manic-depressive) disorder

**Contraindications:**

- Dehydration; sodium imbalance
- Major renal or cardiovascular disease
- Pregnant; breastfeeding

**Adverse effects:**

- Bradycardia; tremors; disturbances in fluid balance (polyuria, edema); seizures; coma
- Hypothyroidism from long-term use
- GI discomfort; confusion; dysrhythmia

**Interactions:**

- Thiazide diuretics; ACE inhibitors; NSAIDs

### Black Box Warning

Lithium toxicity can occur close to therapeutic levels

## Considerations / Patient Education

- May take 7 - 21 days to reach therapeutic blood levels
- 600 - 1200 mg/d in 2-3 doses (to start)
- Increase every few days by 300 mg/d; Max dose 1800 mg/d
- Goal blood serum level 0.6-1.2 mEq/L; should not exceed 1.5 mEq/L
- Lithium levels measured 5 days after beginning and after any dosage change; then q month until 6 mo then q 3 months
- Discuss:
  - Maintain fluid intake 1500-3000 mL/d
  - Maintain consistent Na<sup>+</sup> intake each day (increased Na<sup>+</sup> leads to lower levels of lithium)
  - Take meds with meals

## Anticonvulsant/Antiepileptic Drugs

### Valproate - Carbamazepine - Lamotrigine

- valproate (Depakote, Depakene)
- carbamazepine (Equetro, Tegretrol)
- lamotrigine (Lamictal)

**Mechanism of Action:** T. Class = Anticonvulsants

- Alter electrical conductivity in membranes
- Reduce firing rate of neurons in brain

**Indications:**

- Bipolar disorder (acute mania or maintenance and depression, depends on medication)

**Contraindications:**

- Hepatic disease; pregnancy
- Bone marrow suppression
- Within 14 days of stopping MAOI

**Adverse effects:**

- Tremors; wt gain; sedation; occasionally: thrombocytopenia, pancreatitis, hepatic failure, birth defects
- Anticholinergic (dry mouth, constipation, urinary retention, blurred vision); orthostasis, sedation; ataxia; rash → Important! Rash may progress to Stevens-Johnson syndrome or exfoliative dermatitis (life-threatening)

**Interactions:**

- Varies depending on med: anticoagulants; MAOIs; aspirin; alcohol; grapefruit juice

### Black Box Warning

Pancreatitis; fetal hepatotoxicity; aplastic anemia

## Considerations / Patient Education

- Must obtain baseline liver function tests and CBC; monitor labs and therapeutic levels periodically
- Must obtain baseline EKG and electrolyte levels
- Instruct:
  - Asian descent requires genetic testing (↑ risk for rash)
  - Do not stop med abruptly
  - Monitor for rash and notify HCP if appears
  - Med may cause sensitivity to sun
  - Take meds with food to decrease GI upset



# Psychotropic Drugs



## Drug Treatment for ADHD

### Psychostimulants

- methylphenidate (Ritalin, Daytrana)
- dextroamphetamine (Adderall, Vyvanse)

- Mainstay of treatment for ADHD

T. Class = CNS Stimulants

#### Mechanism of Action:

- Block reuptake of norepinephrine and dopamine

#### Indications:

- ADHD; narcolepsy

#### Contraindications:

- CVD; HTN (moderate to severe)
- Hyperthyroidism
- Within 14 days of stopping MAOI
- Glaucoma

#### Adverse effects:

- Headache, insomnia, agitation, seizures
- Palpitations, arrhythmias
- Dry mouth, N/V, wt loss, growth suppression

#### Interactions:

- Antacids; MAOIs; thiazides
- Caffeine; alcohol; ephedra

### Considerations / Patient Education

- Stimulants:**
  - Instruct to give last dose 4-6 hrs before bedtime
  - Monitor children for continued physical growth and aggressive behavior
  - Monitor blood pressure

- Nonstimulants:**
  - Instruct to report: SOB, chest pain
  - Monitor BP and pulse
  - Do not stop abruptly (to avoid severe rebound HTN)



### Black Box Warning

High potential for abuse

### Nonstimulants

- atomoxetine (Strattera) (T. Class = ADHD drugs)
- guanfacine (Intuniv) (T. Class = Antihypertensives)
- clonidine (Kapvay) (T. Class = Antihypertensives)

#### Mechanism of Action:

- Norepinephrine reuptake inhibitor or alpha-2 adrenergic agonist

#### Indications:

- ADHD

#### Contraindications:

- Heart problems; recent MI; HTN; tachycardia
- Within 14 days of stopping MAOI

#### Adverse effects:

- ↓ appetite, fatigue, dizziness
- Bradycardia, severe rebound HTN, N/V

#### Interactions:

- Albuterol; MAOIs; many antidepressants
- Beta blockers; Ma huang; capsicum

## Antipsychotic Drugs

- First-Generation Antipsychotics
- Second-Generation Antipsychotics



### Black Box Warning

Older adults with dementia: ↑ risk of death

T. Class = Antipsychotics

### First-Generation Antipsychotics (FGAs)

- AKA 'Conventional' 'Typical'
- Not used as much as SGAs due to negative side effects; however cheaper than SGAs and do not cause metabolic syndrome

#### Mechanism of Action:

- Block dopamine receptors

#### Indications:

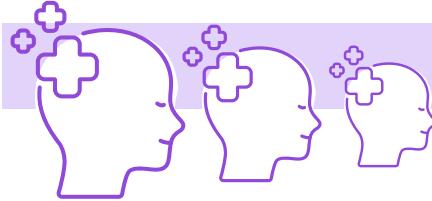
- Delusions and hallucinations of schizophrenia

#### Contraindications/Interactions:

#### Adverse effects:

- Many, including anticholinergic side effects (see next page); Extrapyramidal Symptoms (EPS): acute dystonic reactions, parkinsonism, akathisia, tardive dyskinesia; must monitor for involuntary movements after administering

- chloropromazine (Thorazine)
- fluphenazine (generic)
- perphenazine (generic)
- prochlorperazine (Compazine)
- trifluoperazine (generic)
- thioridazine (generic)
- thiothixene (Navane)
- haloperidol (Haldol)
- pimozide (Orap)



# Psychotropic Drugs



## Antipsychotic Drugs, cont.

### Second-Generation Antipsychotics (SGAs, 'Atypical')

T. Class =  
Antipsychotics

- Considered first-line treatment for psychotic illness
- Target both positive and negative symptoms of schizophrenia
- Produce fewer EPS symptoms and do not cause tardive dyskinesia
- May ↑ risk of metabolic syndrome (↑ weight, ↑ BG and ↑ TG)
  - Greatest risk w/clozapine and olanzapine

#### Mechanism of Action:

- Block dopamine and serotonin receptors

#### Indications:

- Psychotic illness, most commonly schizophrenia

#### Contraindications:

- Tardive dyskinesia; parkinsonism; previous neuroleptic malignant syndrome
- Elderly patient with dementia
- Pituitary prolactinoma
- Tay Sachs disease
- Glaucoma; liver disease
- Severe neutropenia; bone marrow depression

#### Adverse Effects: (varies per medication)

- Hyperlipidemia; diabetes mellitus
- Wt gain and subsequent metabolic syndrome
- QTc prolongation; seizures
- Some extrapyramidal side effects
- Myocarditis; agranulocytosis; cataracts
- Sexual side effects
- Orthostatic hypotension; sedation

#### Interactions:

- Anticholinergics
- Antihypertensives
- Benzodiazepines; opioids
- Protease inhibitors
- Smoking (may lower SGA levels); alcohol

#### Considerations / Patient Education

- Adherence and proper dosage critical
- Alternate intramuscular injection sites
- Measure serum levels during follow-up visits
- Instruct:
  - Avoid extreme perspiration
  - Oral solutions - do not take with soda or tea
  - Report any unusual s/s
  - Sugar-free hard candy or gum for dry mouth
  - Smoking cessation will ↑ clozapine concentration
  - Geodon & Latuda - take with food
  - Saphris - administered sublingual; avoid food/drink for 10 minutes afterwards
  - Fanapt - needs slow dosage titration over 1st few days

- clozapine (Clorazil)
- risperidone (Risperdal)
- quetiapine (Seroquel)
- olanzapine (Zyprexa)
- ziprasidone (Geodon)

- aripiprazole (Abilify)
- paliperidone (Invega)
- iloperidone (Fanapt)
- lurasidone (Latuda)
- asenapine (Saphris)

### Side Effects of Antipsychotic Drugs

#### Extrapyramidal Side Effects (EPS):

- Acute dystonia - Sudden, sustained contraction of one or several muscle groups, usually head or neck; not dangerous unless involves airway
- Akathisia - motor restlessness, causes inability to stay still
- Parkinsonism - group of symptoms that looks like Parkinson's disease (tremor, gait impairment, etc)
- Tardive dyskinesia - involuntary rhythmic movements
  - The Abnormal Involuntary Movement Scale (AIMS) is used to identify and track involuntary movements
  - Treated with valbenazine (Ingrezza)

#### Anticholinergic side effects:

- Urinary retention, dilated pupils, constipation, blurred near vision, tachycardia, dry mucous membranes, ↓ peristalsis

#### Anticholinergic toxicity:

- Greatest risk for older adults and those on multiple anticholinergic drugs
- S/S: Autonomic nervous system instability, delirium with altered mental status, may include hallucinations

#### Neuroleptic malignant syndrome (Seen with FGAs mostly):

- S/S: ↓ consciousness and responsiveness; ↑ muscle tone (muscle rigidity); autonomic dysfunction
- Life threatening medical emergency!

#### Agranulocytosis:

- Mostly associated with clozapine
- Neutropenia may also develop and be fatal
- S/S: infection (fever, chills, sore throat)

#### Prolongation of QT interval:

- Cardiac emergency
- ECG performed on all pts prior to starting antipsychotic to check for existing QT prolongation

#### Liver impairment:

- Seen mostly with FGAs, usually in 1st weeks of therapy
- Monitoring of liver function essential
- S/S: yellowish skin and eyes, ab pain, ascites, vomiting, swelling in lower extremities, dark urine, pale or tar-colored stool, easy bruising, itchy skin, chronic fatigue, nausea, loss of appetite



# Psychotropic Drugs



## Alzheimer's Disease Drug Treatment

- All medications produce only marginal improvement in cognition and functioning. Effectiveness wanes after 1-2 yrs.

### Cholinesterase Inhibitors

- Donepezil (Aricept)
- Rivastigmine (Exelon)
- Galantamine (Razadyne)

#### Mechanism of Action:

- Memory loss of Alzheimer's is attributed to insufficient acetylcholine
- Cholinesterase: the enzyme that breaks down acetylcholine
- Cholinesterase inhibitors: inactivate cholinesterase so that more acetylcholine is available

#### Indications:

- Mild to moderate Alzheimer's

#### Contraindications:

- Pts taking NSAIDs; COPD; renal failure

#### Adverse effects:

- N/V, diarrhea, bradycardia, syncope, UTI

#### Interactions:

- Anticholinergics; carbamazepine; NSAIDs
- Amitriptyline; quinidine; antipsychotics
- Beta blockers; smoking

- Cholinesterase Inhibitors
- NMDA Receptor Antagonist

T. Class = Anti-Alzheimer Drugs

### NMDA Receptor Antagonist

- Memantine (Namenda)

#### Mechanism of Action:

- The neurotransmitter glutamate plays a role in information processing, storage, and retrieval; too much can be destructive to neurons
- Blocks NMDA (N-methyl-D-Aspartate) receptors to regulate the activity of glutamate
- Typically added after trying cholinesterase inhibitor

#### Indications:

- Moderate to severe Alzheimer's (not mild)

#### Contraindications:

- Caution in pt w/seizures or CVD, hepatic failure

#### Adverse effects:

- Aggression, anxiety, heart failure, GI distress

#### Interactions:

- Cimetidine; hydrochlorothiazide; quinidine
- Alcohol, nicotine

### Considerations / Patient Education

- Educate:
  - Med does not alter disease, just improves symptoms
  - Report significant changes in s/s
  - Avoid OTC cold or sleep remedies
  - May need to take with food to ↓ GI side effects
- Monitor for cardiac complications, GI bleeds, pt weights