

Week 1

-Things to know about each of the major antibiotic drug classes

Antibiotic Classes

Antibiotics	Aminoglycoside	Streptomycin Gentamicin	Gram (-)	Inhibit Protein Synthesis (30s)	Bacteremia, Abdominal Infections
Can	Cephalosporins	Ceftriaxone Cefepime	Gram (+)/(-)	Inhibit Cell Wall Synthesis	Skin, Urinary, Resp. Infections
Terminate	Tetracyclines	Tetracycline Doxycycline	Gram (+)/(-)	Inhibit Protein Synthesis (30s)	Lyme Disease, PID, STIs
Protein	Penicillins	Ampicillin Amoxicillin	Gram (+)/(-)	Inhibit Cell Wall Synthesis	ENT, Skin, Urinary Infections
Synthesis	Sulfonamides	Sulfasalazine Sulfamethoxazole	Gram (+)/(-)	Inhibits Folate Synthesis	UTIs, Burns, Eye Infections
For	Fluoroquinolones	Ciprofloxacin Levofloxacin	Gram (+)/(-)	Inhibit DNA Replication	Respiratory & Urinary Infections
Microbial	Macrolides	Azithromycin Erythromycin	Gram (+)	Inhibit Protein Synthesis (50s)	Pneumonia, Sinus, ENT, STIs
Cells	Carbapenems	Meropenem Ertapenem	Gram (+)/(-)	Inhibit Cell Wall Synthesis	Urinary, Abdom. Infections
Like	Lincosamides	Clindamycin	Gram (+)	Inhibit Protein Synthesis (50s)	Skin, Bone, Lung Infections
Germ	Glycopeptides	Vancomycin	Gram (+)	Inhibit Cell Wall Synthesis	MRSA, Skin, Endocarditis

Bactericidal vs. Bacteriostatic

- Bactericidal antibiotics directly kill bacteria
 - preferred for immunocompromised patients such as those with diabetes, HIV, or cancer & for those who have overwhelming infections.
 - Agents: aminoglycosides, beta-lactams, fluoroquinolones, metronidazole, most antimycobacterial agents, streptogramins, & vancomycin.
- Bacteriostatic agents inhibit bacterial proliferation while the host's immune system does the killing.
 - Agents: clindamycin, macrolides, sulfonamides, & tetracyclines
 - Bactericidal agents: "BANG Q R.I.P" - Beta-lactams, Aminoglycosides, Nitroimidazoles (Metronidazole), Glycopeptides (Vancomycin), Quinolones, Rifampicin, Polymyxins (Colistin)
 - Bacteriostatic agents: "Ms. Colt" - Macrolides, Sulfonamides, Chloramphenicol, Oxazolidinones, Lincosamides (Clindamycin), Tetracyclines

Bactericidal antibiotics kill bacteria directly, & bacteriostatic antibiotics stop/weaken bacteria from growing to enable the immune system to take hold of infection

Aminoglycosides (narrow-spectrum antibiotics used primarily against aerobic gram-negative bacilli; disrupt protein synthesis by binding to the 30S ribosomal subunit, resulting in rapid bacterial death) (p. 683)

- **Examples**: Gentamicin, Tobramycin, Amikacin, Neomycin, Kanamycin, Streptomycin, Paromycin, Plazomicin (p. 687)
- **Indications for use**: Treatment of serious infections caused by gram-negative aerobic bacilli (*Pseudomonas aeruginosa*, enterobacteriaceae, topical infection, ocular bacterial infections, intestinal amebiasis, complicated UTI) (p. 687)

- **Contraindications & high-risk patients:** Aminoglycosides should be used with caution in patients with renal impairment, preexisting hearing impairment, & those receiving ototoxic & nephrotoxic drugs. (pp. 685-687)
- **Monitoring needs:** Aminoglycoside levels (peaks & troughs) & renal function must be monitored. Monitor for neurotoxicity, ototoxicity, & nephrotoxicity.
- **Which ones require renal dosing adjustments and how much (i.e., 25%, 50%, etc.):** To avoid serious toxicity, we must reduce dosage size or increase the dosing interval in patients with kidney disease. (p. 685)
*Clarithromycin
- **Patient education:** *Patients should be informed about the symptoms of vestibular & cochlear damage & instructed to report them.
- **Lifespan considerations:** (p. 685)
Infants: Aminoglycosides are approved to treat bacterial infections in infants younger than 8 days. Dosing is based on weight & length of gestation.
Children/adolescents: Aminoglycosides are safe for use against bacterial infections in children & adolescents.
Pregnant women: There is evidence that use of aminoglycosides in pregnancy can harm the fetus.
Breastfeeding women: *Gentamicin* is probably safe to use during lactation. There is limited information regarding its use in this way.
Older adults: Caution must be used regarding decreased renal function in the older adult.

Cephalosporins (Beta-lactam antibiotics similar in structure & actions to the penicillins; bactericidal; often resistant to beta-lactamases, & active against a broad spectrum of pathogens; most widely used group of antibiotics) (p. 669)

- **Examples:** 1st generation: Cephalexin (Keflex); 2nd generation: Cefoxitin, Cefaclor (Ceclor); 3rd generation: Cefotaxime, Cefdinir, Ceftriaxone (Rocephin); 4th generation: Cefepime; 5th generation: Ceftaroline
- **Indications for use:**
1st generation: Staphylococci or streptococci (Use in patients with mild PCN allergy, strep pharyngitis, skin infections, & surgical prophylaxis)
2nd generation: *Haemophilus influenzae*, *Klebsiella*, pneumococci, & staphylococci (Otitis, sinusitis, & respiratory tract infections)
3rd generation: *Pseudomonas aeruginosa*, *Neisseria gonorrhoeae*, & *Klebsiella*, *Serratia* (Meningitis, gram-negative nosocomial infections)
4th generation: *Pseudomonas aeruginosa* (Hospital-acquired pneumonia & complicated intra-abdominal & UTIs due to resistant pseudomonas)
5th generation: Methicillin-resistant *Staphylococcus aureus* (MRSA-associated infections). (p. 671)
- **Contraindications & high-risk patients:** Cephalosporins are contraindicated for patients with a history of allergic reactions to cephalosporins or severe reactions to penicillin. Patients using *cefazolin* & *cefotetan* must not consume alcohol. Use *cefotetan*, *cefazolin*, & *ceftriaxone* cautiously in patients taking other agents that also promote bleeding (anticoagulants, thrombolytics, NSAIDs, etc). (pp. 670-671)
- **Monitoring needs:** Monitor for signs of *C. dif* infection & renal function in patients with renal impairment and/or prolonged use.
- **Which ones require renal dosing adjustments and how much (i.e., 25%, 50%, etc.):** In patients with renal insufficiency, dosages of most cephalosporins must be reduced to prevent accumulation to toxic levels. (EXCEPTION: *Ceftriaxone* (3rd generation) is eliminated largely by the liver, so dosage reduction is unnecessary in patients with renal impairment) (p. 669)
- **Patient education:** *All cephalosporins can promote *C. dif* infection, so patients should be instructed to report an increase in stool frequency.
- **Lifespan considerations:**
Infants: 3rd generation cephalosporins are used to treat bacterial infections in neonates as well as infants.
Children/adolescents: Cephalosporins are commonly used to treat bacterial infections in children, including otitis media & gonococcal & pneumococcal infections.
Pregnant women: All cephalosporins appear safe for use in pregnancy.
Breastfeeding women: Cephalosporins are generally not expected to cause adverse effects in breastfed infants.
Older adults: Doses should be adjusted in older adults with decreased renal function.

Tetracyclines (broad-spectrum antibiotics active against a wide variety of gram-positive & gram-negative bacteria;