THE NEED-TO-KNOW ANTIMICROBIALS

Yearly update by Rho Chi

Class of 2008

University of Washington School of Pharmacy

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Generic name	AMOXICILLIN
Proprietary name	Amoxil, Polymox
Class (generation)	Aminopenicillin
MOA (bactericidal/bacteriostatic)	Binds to PBPs to inhibit cell wall synthesis, bactericidal
Spectrum (Gm+, Gm-, anaerobes)	Gram +: streptococci, *Enterococcus*, but **NOT** *S. aureus* Gram - : only a few (*E. coli, Proteus* spp, a few others)…**lots of resistance** No below-the-diaphragm anaerobic activity
DOC for which diseases	AOM, ABS, prophylaxis of endocarditis before dental, esophageal, and upper respiratory procedures
Absorption, distribution, metabolism, excretion	Absorbed well from GI tract; widely distributed in tissues (especially inflamed tissue); renal excretion
PD (time vs. concentration dependent killing)	Time-dependent
Side effects (what, how common, monitoring)	Diarrhea--common, call MD if excessive, blood in stool or abdominal cramping
Allergies	Possible anaphylaxis or rash
Drug interactions	Not common
Dose (renal/hepatic failure, obesity)	AOM: 90mg/kg/day, div BID x 10 days ABS mild/moderate, w/out recent abx: 1 g TID x 10 days Endocarditis prophylaxis: 2 g po x 1 hr before appt. CrCl 10-50 mL/min: Give q8-12h <10 mL/min: Give q24h
Pregnancy, pediatrics issues	Pregnancy B, ok in pediatrics
Relative cost	Generic and very inexpensive

Generic name	AMOXICILLIN/CLAVULANIC ACID
Proprietary name	Augmentin
Class (generation)	β-lactam/β-lactamase inhibitor combination
MOA (bactericidal/bacteriostatic)	Amox: binds to penicillin binding proteins (PBPs) to inhibit protein synthesis (bactericidal) Clavulanic acid: inhibits β-lactamases
Spectrum (Gm+, Gm-, anaerobes)	Gram + (*S. aureus, Enterococcus*, streptococci) enteric gram -, H.flu, M.cat anaerobes below the diaphragm **Very similar to amp/sulbactam in activity**
DOC for which diseases	Refractory otitis media, acute/severe bacterial sinusitis, dog/cat bites, aspiration CAP
Absorption, distribution, metabolism, excretion	Absorption: 75%, Distribution: inflammation-mediated, gets to most tissues Excretion: Renal
PD (time vs. concentration dependent killing)	Time-dependent
Side effects (what, how common, monitoring)	Common: N/V, antibiotic associated diarrhea Rare: thrombocytopenia
Allergies	"Penicillin allergy" rash: 5-10%, anaphylaxis: 0.001%
Drug interactions	Allopurinol may increase incidence or rash
Dose (renal/hepatic failure, obesity)	Normal Doses: Refractory otitis media: 90mg/kg/day div q12hX10d (Pediatric) Acute/severe bact. Sinusitis & aspiration CAP: augmentin XR 2 tabs po BID X10-14d Dog/cat bites: 875 mg BID X 3-5d (prophylaxis) or 10-14d (infected wound) Renal failure: adjustment may be required
Pregnancy, pediatrics issues	Pregnancy cat B, safe in pediatrics
Relative cost	Moderately expensive

Generic name	AMPICILLIN
Proprietary name	Omipen, Polycillin
Class (generation)	Aminopenicillin
MOA (bactericidal/bacteriostatic)	CIDAL, acid unstable antibiotic that inhibits the biosynthesis of cell wall mucopeptide (peptidoglycan). Most effective when bacteria are growing (subject to the inoculum effect).
Spectrum (Gm+, Gm-, anaerobes)	Alone: covers streptococci and *Enterococcus*, but not *S. aureus* Gm- is ok for a few organisms, but watch out for resistance. **No *Pseudomonas* coverage.** Anaerobe coverage is poor because of β-lactamases below the diaphragm With sulbactam: modest Gm- improvement, but much better gm+ (including *S. aureus*) and anaerobe improvement
DOC for which diseases	Meningitis (for *Listeria monocytogenes*) Gastroenteritis (for *Listeria monocytogenes*) Complicated UTI/catheters (alternative choice) Pneumonia (not reliable for *H. influenzae*)
Absorption, distribution, metabolism, excretion	Good GI absorption Distribution: bound to plasma proteins, diffuses readily into most tissues with inflammation. Excretion: Largely unchanged in the urine
PD (time vs. concentration dependent killing)	Time dependent killing
Side effects (what, how common, monitoring)	Fever, rash fairly common, diarrhea is a serious problem
Allergies	0.7-10% Rash and anaphylaxis. X-sensitivity to all PCN's, and varying X-sensitivity to cephalosporins
Drug interactions	Allopurinol (increases frequency of rash) Oral contraceptives (the general warning)
Dose (renal/hepatic failure, obesity)	Normal: 250-500 mg po q6h OR 150-200 mg/kg/d IV Max IV dose in adults: 2 gm IV q4h Renal Failure: CrCl >50-90 same, CrCl 10-50: q6-12h, CrCl <10: q12-24h
Pregnancy, pediatrics issues	Pregnancy category B, excreted in breast milk, may lead to sensitization
Relative cost	Oral 500 mg ~ 35 cents (CHEAP); IV modestly priced

Generic name	AMPICILLIN/SULBACTAM
Proprietary name	Unasyn
Class (generation)	Aminopenicillin/β-lactamase inhibitor combination
MOA (bactericidal/bacteriostatic)	Bactericidal. Inhibits cell wall synthesis by binding to PBPs; sulbactam is a β lactamase inhibitor
Spectrum (Gm+, Gm-, anaerobes)	G+: streptococci, *S. aureus*, *Enterococcus* G-: *E. coli, Klebsiella, Proteus, H. influenzae* Anaerobes: good for below-diaphragm **The sulbactam improves the *S. aureus* and anaerobic coverage of ampicillin, but only modestly improves G- coverage**
DOC for which diseases	Intra-abdominal infections With advanced macrolide (azithromycin) for CAP treated on inpatient basis, non ICU (especially if aspiration pneumonia is a concern)
Absorption, distribution, metabolism, excretion	A-IV only D-to bile, blister, tissue fluids, CSF (inflamed). M-not particularly significant E-75-85% excreted unchanged in urine in 8 hrs. Half-life 1.3 hours.
PD (time vs. concentration dependent killing)	Time dependent killing
Side effects (what, how common, monitoring)	Rash, diarrhea
Allergies	Contraindicated in patients with penicillin and (true) cephalosporin allergies (about 20-40% chance the latter will be allergic to penicillins)
Drug interactions	Ampicillin levels can be increased by probenecid. Penicillins may increase methotrexate exposure during concurrent therapy. Monitor MTX levels.
Dose (renal/hepatic failure, obesity)	1.5-3 g IV q6h Adjust for renal dysfunction
Pregnancy, pediatrics issues	Safe in pediatric and pregnant patients (B)
Relative cost	Moderately expensive

Generic name	AZITHROMYCIN
Proprietary name	Zithromax, Zmax
Class (generation)	Azalide (advanced-generation macrolide)
MOA (bactericidal/bacteriostatic)	Inhibits bacterial growth by suppressing RNA-dependent protein synthesis, bacteriostatic
Spectrum (Gm+, Gm-, anaerobes)	Gram pos: *S. pneumoniae* (lots of resistance, though), other streptococci; not a good staph drug (no MRSA) Gram neg: *H. influenzae, M. catarrhalis* (not really a good Gram-negative drug) Atypicals (*Legionella, Mycoplasma, Chlamydia*): good coverage No useful anaerobic activity below diaphragm
DOC for which diseases	Penicillin allergic AOM, CAP w/ no previous antibiotics, *Chlamydia* STD
Absorption, distribution, metabolism, excretion	Absorption:good (newest data suggest no reason to avoid antacids), bioavailability 37% Tissue half-life: 2-4 days Distribution: especially good into lungs
PD (time vs. concentration dependent killing)	AUC/MIC correlates best with activity
Side effects (what, how common, monitoring)	N/V, antibiotic associated diarrhea (rare) Prolong QTc interval (generally minor) **Very well-tolerated drug in general**
Allergies	Rare
Drug interactions	Digoxin: increases serum levels of digoxin?
Dose (renal/hepatic failure, obesity)	Normal Doses: Pen-allergic AOM: 30 mg/kg/day (single dose, or divided over 3-5 days) Pharyngitis: 60 mg/kg/day (divided over 5 days) CAP: 500 mg day 1, then 250 mg day 2-5 (adult) Chlamydia: 1 gm x1
Pregnancy, pediatrics issues	Pregnancy category B, safe in pediatrics
Relative cost	Moderate

Generic name	AZTREONAM
Proprietary name	Azactam
Class (generation)	Monobactam
MOA (bactericidal/bacteriostatic)	Bactericidal. Inhibits cell wall synthesis by binding to PBPs.
Spectrum (Gm+, Gm-, anaerobes)	Gram (-) including *Pseudomonas*; no G+, no anaerobes. Not a drug that is commonly used.
DOC for which diseases	Useful in patients with a history of severe allergy to penicillin (extremely low rate of cross-allergenicity). Used with metronidazole in secondary peritonitis.
Absorption, distribution, metabolism, excretion	Given IV/ IM. Half life approx 1.7 hrs. Distributes throughout body. Mainly excreted in the urine. 12% fecal.
PD (time vs. concentration dependent killing)	Time dependent
Side effects (what, how common, monitoring)	Pain at injection site, G.I upset, Drug-induced eosinophilia (all somewhat rare)
Allergies	**Virtually no cross reactivity with other ß-lactams**
Drug interactions	Monitor renal function if used with aminoglycosides
Dose (renal/hepatic failure, obesity)	1-2 gm IV q6-8h. However, dose adjustments needed for renal dysfunction. The liver plays a minor role in elimination.
Pregnancy, pediatrics issues	Pregnancy category B, safety/effectiveness under 9 months not established
Relative cost	Expensive- no generic available

Generic name	CEFAZOLIN
Proprietary name	Ancef, Kefzol
Class (generation)	1st generation cephalosporin (IV drug)
MOA (bactericidal/bacteriostatic)	Bactericidal. Inhibits cell wall synthesis by binding to PBPs.
Spectrum (Gm+, Gm-, anaerobes)	Mainly gram +, a few enteric GNRs. No anaerobes below the diaphragm.
DOC for which diseases	Surgical prophylaxis, occasional skin infections.
Absorption, distribution, metabolism, excretion	Distributes into bone well. Does not distribute into CSF in useful concentrations, even if inflamed. Excreted mainly unchanged in urine.
PD (time vs. concentration dependent killing)	Time dependent killing.
Side effects (what, how common, monitoring)	GI upset
Allergies	Cross reactivity possible for those with penicillin allergies (under 5%)
Drug interactions	Nothing significant
Dose (renal/hepatic failure, obesity)	1-2 gm IV q8h Decrease dose in renal insufficiency
Pregnancy, pediatrics issues	Pregnancy category B
Relative cost	Relatively cheap- generic available.

Generic name	CEFDINIR
Proprietary name	Omnicef
Class (generation)	3rd generation oral cephalosporin
MOA (bactericidal/bacteriostatic)	Bactericidal. Inhibits cell wall synthesis by binding to PBPs.
Spectrum (Gm+, Gm-, anaerobes)	Gram (+) cocci like Strep. Might work for *S. aureus* (not MRSA). Like all cephalosporins it is ineffective for *Enterococcus*.
DOC for which diseases	Some pediatricians favor cefdinir for AOM because of its relatively pleasant taste
Absorption, distribution, metabolism, excretion	Absorption independent of food. Half life approx 1.7 hrs. Distributes into tissue. Excreted renally.
PD (time vs. concentration dependent killing)	Time dependent
Side effects (what, how common, monitoring)	GI upset, headache
Allergies	Cross reactivity possible for those with penicillin allergies (but chance is <1%)
Drug interactions	Antacids may decrease absorption
Dose (renal/hepatic failure, obesity)	AOM: 14 mg/kg/day Decrease dose for renal dysfunction
Pregnancy, pediatrics issues	Pregnancy category B
Relative cost	Moderately expensive- no generic available.

Generic name	CEFEPIME
Proprietary name	Maxipime
Class (generation)	4th generation cephalosporin
MOA (bactericidal/bacteriostatic)	Bactericidal
Spectrum (Gm+, Gm-, anaerobes)	Summary: Best of ceftriaxone + best of ceftazidime • Gm+ • Gm- • lacks anaerobes • *Pseudomonas* • β lactamase stable
DOC for which diseases	• ICU monotherapy, maybe better than imipenem because it lacks anaerobe coverage • In combination with ciprofloxacin for ICU treatment of CAP, 1-2 g IV q 12h x 10 days
Absorption, distribution, metabolism, excretion	A: IV, IM D: 20% protein bound, CSF concentrations decent M: Liver metabolism minor E: 85% unchanged in the urine
PD (time vs. concentration dependent killing)	Time-dependent
Side effects (what, how common, monitoring)	• headache, confusion (rare) • bleeding and bruising (rare, monitor PT) • Mild diarrhea, more common
Allergies	Less than 1% cross-reactivity if PCN allergy (rash)
Drug interactions	Nothing significant
Dose (renal/hepatic failure, obesity)	1-2 gm IV q8-12h Adjust for renal dysfunction
Pregnancy, pediatrics issues	Pregnancy category B
Relative cost	2g = $35-40

Generic name	CEFOTAXIME
Proprietary name	Claforan
Class (generation)	3rd generation cephalosporin
MOA (bactericidal/bacteriostatic)	Bactericidal
Spectrum (Gm+, Gm-, anaerobes)	• Gm+ • Gm- (bacilli), but not *Pseudomonas* • No below diaphragm anaerobes
DOC for which diseases	• SBP: 2g IV q 8h x 5 days • Bacterial meningitis for 0-1 month old along with ampicillin, 75 mg/kg q 6h
Absorption, distribution, metabolism, excretion	A: IV only D: 30-51% protein bound, CSF penetration good M: Liver converts it to active metabolite E: Renal 50-85%, biliary 15-75%
PD (time vs. concentration dependent killing)	Time-dependent
Side effects (what, how common, monitoring)	• Agranulocytosis (rare) • Steven-Johnson syndrome (rare) • Mild diarrhea, nausea (more common)
Allergies	Less than 1% cross-reactivity if PCN allergy (rash)
Drug interactions	Nothing significant
Dose (renal/hepatic failure, obesity)	1-2 gm IV q8-12h (adults) Adjust for renal dysfunction
Pregnancy, pediatrics issues	Pregnancy category B Safe in pediatrics
Relative cost	2g = $22

Generic name	CEFPODOXIME PROXETIL
Proprietary name	Vantin
Class (generation)	3rd generation oral cephalosporin
MOA (bactericidal/bacteriostatic)	Bactericidal – inhibits cell wall synthesis
Spectrum (Gm+, Gm-, anaerobes)	Some Gram + and Gram – bacteria (stable against β-lactamases) NOT: MRSA, *Enterococcus, Pseudomonas, Enterobacter*
DOC for which diseases	Can be used in AOM if recent antibiotic use Can be used in ABS if recent antibiotic use
Absorption, distribution, metabolism, excretion	Bioavailability 46% Minimal metabolism
PD (time vs. concentration dependent killing)	Time-dependent
Side effects (what, how common, monitoring)	Diarrhea, nausea –common
Allergies	Watch for penicillin allergy (but cross-allergenicity is probably less than 1%)
Drug interactions	Antacids
Dose (renal/hepatic failure, obesity)	10 mg/kg/day (AOM) 200 mg po bid (ABS)
Pregnancy, pediatrics issues	Pregnancy category B
Relative cost	Moderate

Generic name	CEFTAZIDIME
Proprietary name	Fortaz, Tazicef, Tazidime
Class (generation)	Third generation cephalosporin
MOA (bactericidal/bacteriostatic)	Bactericidal
Spectrum (Gm+, Gm-, anaerobes)	Gm+: limited; don't trust for these Gm-: *Pseudomonas*, most Enterobacteriaceae Anaerobes: not useful for below-the-diaphragm
DOC for which diseases	1. *Pseudomonas* pneumonia in CF patients 2. Other diseases due to Gram-negative bacteria: life-threatening, susceptible Gram-negative organisms including *Pseudomonas* and Enterobacteriaceae 3. Gram-negative osteomyelitis, especially due to *Pseudomonas* 4. Hospital acquired peritonitis (in combination with an antianaerobic drug) 5. Meningitis due to *Pseudomonas* 6. Nosocomially-acquired UTI
Absorption, distribution, metabolism, excretion	A: Parenteral only D: widely throughout the body including bone, bile, skin, CSF, endometrium, heart, pleural and lymphatic fluids M: minimally metabolized E: 90-96% renal
PD (time vs. concentration dependent killing)	Time dependent killing
Side effects (what, how common, monitoring)	Hypersensitivity (rash), transient eosinophilia, increased liver function tests
Allergies	Hypersensitivity to ceftazidime
Drug interactions	Nothing significant
Dose (renal/hepatic failure, obesity)	1-2 gm IVq8h Adjust for renal dysfunction
Pregnancy, pediatrics issues	Category B; OK to use in pediatrics
Relative cost	Moderately expensive

Generic name	CEFTRIAXONE
Proprietary name	Rocephin
Class (generation)	3rd generation cephalosporin
MOA (bactericidal/bacteriostatic)	Binds to PBPs to inhibit cell wall synthesis, bactericidal
Spectrum (Gm+, Gm-, anaerobes)	Gram – (*no Pseudomonas),* Gram +, no below diaphragm anaerobes
DOC for which diseases	CAP, inpatient, when *Pseudomonas* not an issue; bacterial meningitis for 1 mo-50 yrs; necrotizing fasciitis; NVE caused by HACEK group, gonorrhea (urethral, cervical, rectal, pharyngeal, and DGI)
Absorption, distribution, metabolism, excretion	100% absorption w/IM or IV administration; widely distributed in tissues including CSF, synovial fluid; minimally metabolized; biliary excretion
PD (time vs. concentration dependent killing)	Time-dependent
Side effects (what, how common, monitoring)	Rash, diarrhea, eosinophilia, increase in LFTs, all uncommon, monitor for severity
Allergies	Rash and anaphylaxis uncommon
Drug interactions	Not common
Dose (renal/hepatic failure, obesity)	CAP, inpatient, when *Pseudomonas* not an issue: 2 g IV Q24h (+adv. macrolide) Bacterial meningitis for 1 mo-50 yrs: 2 g IV q12h (+vanco+dex) Necrotizing fasciitis: 2 g q12h (+ clindamycin) NVE caused by HACEK group: 2 g IV Q24h x4 wks Gonorrhea (urethral, cervical, rectal, pharyngeal): 125 mg IM x 1 DGI: 1 g IM/IV q24h x 7 days No dose adjustment necessary for renal disease, but possibly for severe hepatic impairment
Pregnancy, pediatrics issues	Pregnancy B, safe in pediatrics
Relative cost	$40-50 per gram

Generic name	CEFUROXIME AXETIL
Proprietary name	Ceftin
Class (generation)	Cephalosporin (oral, second generation)
MOA (bactericidal/bacteriostatic)	CIDAL, inhibit mucopeptide synthesis (peptidoglycan) in the bacterial cell wall making it unstable; more effective against rapidly growing bacteria (subject to the inoculum effect)
Spectrum (Gm+, Gm-, anaerobes)	Ok Gm+ (not as potent as 1st gen) Better Gm- than 1st gen (not *Pseudomonas*) Anaerobic coverage not especially good Better β-lactamase resistance than 1st gen, therefore better for resistant strains than 1st gen
DOC for which diseases	AOM, ABS (one of a number of options)
Absorption, distribution, metabolism, excretion	Absorption: absorbed from GI and rapidly hydrolyzed in intestinal mucosa and blood, take with food Distribution: widely distributed to most tissues and fluids including CSF (not used for meningitis, though) Metabolism: metabolized to free cefuroxime plus acetaldehyde and acetic acid Excretion: primarily excreted renally
PD (time vs. concentration dependent killing)	Time-dependent killing
Side effects (what, how common, monitoring)	Anemia, eosinophilia, neutropenia (very rare)
Allergies	Cross-sensitivity to penicillins probably on the order of 1-2%
Drug interactions	None to speak of Oral contraceptives—the general warning with antibiotics
Dose (renal/hepatic failure, obesity)	PO: 250-500 mg q12h Oral suspension for AOM: 30 mg/kg day divided q12h Adjust for renal dysfunction
Pregnancy, pediatrics issues	Category B, excreted in breast milk in small quantities
Relative cost	Oral moderately priced

Generic name	CEPHALEXIN
Proprietary name	Velosef
Class (generation)	1st generation cephalosporin
MOA (bactericidal/bacteriostatic)	Bactericidal. Inhibits cell wall synthesis.
Spectrum (Gm+, Gm-, anaerobes)	Better Gm + than Gm -. Gm+: *S. aureus* (not MRSA); *S. pneumoniae* Gm-: *E.coli*; *Klebsiella* sp; Proteus *mirabilis* Anaerobic activity: not good
DOC for which diseases	Skin infections caused by Gm + organisms
Absorption, distribution, metabolism, excretion	Well absorbed from the GI tract and widely distributed throughout the body and many tissues. Primarily eliminated by kidney excretion.
PD (time vs. concentration dependent killing)	Time dependent killing
Side effects (what, how common, monitoring)	May cause mild diarrhea.
Allergies	Not given to patient with a history of anaphylaxis to penicilin or known cephalosporin hypersensitivity. Probably OK to give to a patient with a history of penicillin rash (cross-allergenicity <5%, if that high)
Drug interactions	None of significance
Dose (renal/hepatic failure, obesity)	Normal: 250-500mg po q6h Renal failure: increase dosing interval to q12h
Pregnancy, pediatrics issues	Pregnancy category B; safe in pediatrics
Relative cost	500 mg generic $0.44

Generic name	CIPROFLOXACIN
Proprietary name	Cipro
Class (generation)	FQ, early 2nd generation, non-respiratory
MOA (bactericidal/bacteriostatic)	Binds to DNA gyrase and/or topoisomerase IV to inhibit DNA replication and repair. Bactericidal.
Spectrum (Gm+, Gm-, anaerobes)	Gram-, limited Gram +, no anaerobic coverage
DOC for which diseases	Acute uncomplicated cystitis (when TMP/SMX resistance ~20% and for elderly patients), acute uncomplicated pyelonephritis
Absorption, distribution, metabolism, excretion	Bioavailability 70%; widely distributed in most tissues, including synovial and prostatic fluids; eliminated by both renal and nonrenal mechanisms. Half-life 4 hours.
PD (time vs. concentration dependent killing)	Concentration-dependent
Side effects (what, how common, monitoring)	Nausea, CNS toxicity, tendon toxicity (rare). All uncommon, monitor for severity.
Allergies	Rash uncommon, anaphylaxis rare
Drug interactions	CYP1A2 inhibitor
Dose (renal/hepatic failure, obesity)	Acute uncomplicated cystitis: 250 mg po BID x 3 days for non-elderly, 7-10 days for elderly Acute uncomplicated pyelonephritis: 500 mg po BID x 10-14 days or 200-400 mg IV q12h x 7-14 days CrCl 10-50 mL/min: decrease dose by 50-75% CrCl <10 mL/min: decrease dose by 50%
Pregnancy, pediatrics issues	Pregnancy category C, not FDA-approved in pediatrics except for treatment of anthrax and complicated pyelonephritis
Relative cost	Generic and relatively inexpensive

Generic name	CLARITHROMYCIN
Proprietary name	Biaxin
Class (generation)	Advanced macrolide
MOA (bactericidal/bacteriostatic)	Bacteriostatic
Spectrum (Gm+, Gm-, anaerobes)	Gm+: Group A,B,C, and G streptococci; *S. pneumoniae*; MSSA Gm-: *M. catarrhalis, H. influenzae* Atypicals: *Mycoplasma, Chlamydophila, Legionella* No usable antianaerobic activity
DOC for which diseases	□ Acute exacerbation of chronic bronchitis □ Acute otitis media (alternative) □ Community acquired pneumonia (alternative in certain patients) □ Maxillary sinusitis, acute (alternative) □ Tonsillitis/pharyngitis □ *H. pylori*
Absorption, distribution, metabolism, excretion	Bioavailability: 50% Vd 4 L/kg, protein binding 42-50% Metabolized in liver (active metabolite) Mixed renal and nonrenal elimination, half life 5-7 hr
PD (time vs. concentration dependent killing)	Time-dependent killing
Side effects (what, how common, monitoring)	Common: nausea and vomiting, diarrhea, headache. Metallic taste is particularly bothersome to patients.
Allergies	True allergy to clarithromycin is rare
Drug interactions	Inhibitor and substrate of CYP3A4
Dose (renal/hepatic failure, obesity)	Normal:500 mg q12h po or ER 1 gm po qd Renal dosing: CrCl 10-50: 75% of the dose CrCl<10: 50 % of the dose or extend the dosing interval.
Pregnancy, pediatrics issues	Category C Can be used in pediatric patients
Relative cost	500mg About 5 dollar per tab ER: also about 5 dollar per tab

Generic name	CLINDAMYCIN
Proprietary name	Cleocin
Class (generation)	Lincosamide (the only one on the US market)
MOA (bactericidal/bacteriostatic)	B'static: binds to 50S ribosomal subunit, inhibiting protein synthesis. B'cidal in high concentrations (but still generally viewed as a static drug) Side benefit: appears to decrease toxin synthesis by certain organisms
Spectrum (Gm+, Gm-, anaerobes)	**Anaerobes** (*B. fragilis* group). Gm (+) cocci [including streptococci and community-associated-MRSA]. No aerobic G- activity.
DOC for which diseases	Necrotizing faciitis [in combination with a β-lactam – ceftriaxone or Pen G if GABS]. Also a popular choice for a lung abscess.
Absorption, distribution, metabolism, excretion	BA: 90% T1/2: 1.5-6.5hrs, hepatic metabolism Distribution: High concentrations in bone and urine; no significant levels in CSF, even with inflamed meninges; crosses placenta; enters breast milk Eliminated in feces and bile Excretion: Urine (10%) and feces (~4%) as active drug and metabolites
PD (time vs. concentration dependent killing)	Time dependent
Side effects (what, how common, monitoring)	Diarrhea (20-30%) Pseudomembranous colitis due to *C. difficile* overgrowth (discontinue if significant diarrhea, cramps, or passage of blood and mucus occur)
Allergies	No major issues.
Drug interactions	Increased duration of neuromuscular blockade from tubocurarine, pancuronium (contraindicated in botulism cases) .
Dose (renal/hepatic failure, obesity)	Usual dose: Oral: 150-450 mg q6h (max: 1.8 g/day) IM, IV: 600-900mg q8h (max: 4.8 g/day) Adjustment is recommended in patients with severe hepatic disease.
Pregnancy, pediatrics issues	Pregnancy Category B, safe in kids
Relative cost	$8.00/600mg IV ($24-$36/day)

Generic name	COLISTIN (POLYMYXIN E), administered as the prodrug COLISTIMETHATE
Proprietary name	Coly-Mycin M Parenteral
Class (generation)	Polymyxin (a cyclic polypeptide)
MOA (bactericidal/bacteriostatic)	Bactericidal. Binds to lipopolysaccharide and alters cell membrane permeability, leading to spillage of cytoplasmic content and cell death
Spectrum (Gm+, Gm-, anaerobes)	Many Gram-negative bacilli including *P. aeruginosa* and *Acinetobacter*. However, Gram-positive organisms, anaerobes, and a few common Gram-negatives are resistant.
DOC for which diseases	None. Useful for serious infections caused by Gram-negative bacilli resistant to everything else. Used in inhaled form in patients with cystic fibrosis.
Absorption, distribution, metabolism, excretion	Not absorbed PO. CSF concentrations uncertain (can be directly instilled). A small fraction of administered colistimethate is hydrolyzed to colistin, which is mostly eliminated nonrenally. Half-lives: colistimethate 2 hours, colistin 4 hours.
PD (time vs. concentration dependent killing)	Concentration-dependent, limited postantibiotic effect
Side effects (what, how common, monitoring)	Nephrotoxicity (10-15%); neurotoxicity (7%)
Allergies	2% incidence of hypersensitivity
Drug interactions	Not well studied
Dose (renal/hepatic failure, obesity)	Supplied in vials labeled with colistin base activity (150 mg each, equivalent to 400 mg colistimethate sodium). IV Dose: 2.5-5.0 mg/kg/day of colistin base activity, divided 2-4 times a day. Duration depends on indication. Adjust for renal dysfunction. Inhaled dose of colistimethate sodium: 40-60 mg, 2-3 times a day. Better tolerated than inhaled colistin.
Pregnancy, pediatrics issues	Category C
Relative cost	About $100/day (IV)

Generic name	DAPTOMYCIN
Proprietary name	Cubicin
Class (generation)	Cyclic lipopeptide
MOA (bactericidal/bacteriostatic)	Binds to bacterial membranes and causes rapid depolarization of membrane potential, leading to inhibition of protein, DNA, and RNA synthesis and cell death. **Rapidly bactericidal**.
Spectrum (Gm+, Gm-, anaerobes)	Vancomycin-like spectrum (includes VRE, MRSA,GISA, PRSP). No useful G- activity, no anaerobic coverage.
DOC for which diseases	Approved for skin infections, but not likely to be a big use for this drug, Good use: endocarditis due to VRE Also an for endocarditis due to MRSA and non-MRSA *S. aureus*
Absorption, distribution, metabolism, excretion	A: IV only D: thought to have limited tissue penetration; binds to lung surfactant so **must never be used for pulmonary infections** M: Minimal metabolism E: Renally excreted
PD (time vs. concentration dependent killing)	Concentration-dependent killing
Side effects (what, how common, monitoring)	Increased CPK—monitor for muscle pain or weakness; potential to cause muscle damage still uncertain
Allergies	Hypersensitivity reactions possible
Drug interactions	HMG-CoA reductase inhibitors—Cubist recommends discontinuing them during daptomycin therapy
Dose (renal/hepatic failure, obesity)	Usual dose for skin infections: 4 mg/kg q24h If CrCl < 30: 4 mg/kg q 48 h Endocarditis dose (unapproved) 6 mg/kg q24h
Pregnancy, pediatrics issues	Pregnancy: B Pediatrics: Not approved in patients under 18
Relative cost	$135 per 500mg vial

Generic name	DICLOXACILLIN
Proprietary name	Various
Class (generation)	Penicillinase-resistant penicillin
MOA (bactericidal/bacteriostatic)	Bactericidal; inhibits cell wall synthesis
Spectrum (Gm+, Gm-, anaerobes)	*S. aureus* (MSSA), streptococci **NOT ACTIVE FOR MRSA or coagulase-negative staphylococci**
DOC for which diseases	Impetigo (especially bullous) Ecthyma In general, a reasonable choice for a skin infection due to *S. aureus* or *S. pyogenes*
Absorption, distribution, metabolism, excretion	A: Oral - 60-80% D: volume of dist: 0.16 L/kg M: Hepatic E: Mainly by the liver
PD (time vs. concentration dependent killing)	Time-dependent killing
Side effects (what, how common, monitoring)	Diarrhea (don't expect a lot) Rash
Allergies	Hypersensitivity reaction possible
Drug interactions	Nothing special
Dose (renal/hepatic failure, obesity)	No specific adjustment necessary in renal failure
Pregnancy, pediatrics issues	Pregnancy: B Pediatric: OK
Relative cost	500 mg generic = $1.20

Generic name	DOXYCYCLINE
Proprietary name	Vibramycin
Class (generation)	Tetracycline
MOA (bactericidal/bacteriostatic)	Bacteriostatic, binds to bacterial ribosome
Spectrum (Gm+, Gm-, anaerobes)	Gram (+) and Gram (-) (resistance is a problem with tetracyclines) Atypical pathogens (for CAP)
DOC for which diseases	Possible for CAP (healthy, no recent antibiotics) Possible for cat bite in penicillin-allergic patient
Absorption, distribution, metabolism, excretion	A: oral, almost complete D: wide M/E: feces 30%, urine 23%
PD (time vs. concentration dependent killing)	Concentration-dependent killing
Side effects (what, how common, monitoring)	Nausea—a common problem with this drug "Bad taste" Diarrhea Less phototoxicity than with tetracycline
Allergies	Not common
Drug interactions	Increases activity of warfarin Cations (aluminum, iron, magnesium) decrease absorption of doxycycline
Dose (renal/hepatic failure, obesity)	100 mg po q12h No specific adjustments necessary in renal failure
Pregnancy, pediatrics issues	Pregnancy: D Not in children under 8
Relative cost	Inexpensive

Generic name	ERTAPENEM
Proprietary name	Invanz
Class (generation)	Carbapenem
MOA (bactericidal/bacteriostatic)	Bactericidal. Inhibits cell wall synthesis by binding to PBPs. Excellent β-lactamase stability (typical of a carbapenem).
Spectrum (Gm+, Gm-, anaerobes)	More active than imipenem against Enterobacteriaceae, but **not clinically useful for *P. aeruginosa***. A bit less active than imipenem against gram-positive aerobic organisms and anaerobes. **Poor activity against *Enterococcus*, *Stenotrophomonas,* and *Acinetobacter.***
DOC for which diseases	Not DOC for anything, but a useful alternative for mild-to-moderate intraabdominal infection, and also CAP
Absorption, distribution, metabolism, excretion	Parenteral only. 85-95% protein bound, Vd 8L at steady state. Renal excretion 80% of total drug (40% unchanged, 40% ring-opened form). Elimination half-life 4 hours, prolonged in renal insufficiency.
PD (time vs. concentration dependent killing)	Time-dependent (like all β-lactams)
Side effects (what, how common, monitoring)	Typical of a β-lactam (GI, dermatologic). Seizures not a problem (as they were initially with imipenem). May cause LFT and hematologic abnormalities (rare).
Allergies	Avoid in patients with history of penicillin-induced anaphylaxis
Drug interactions	None significant
Dose (renal/hepatic failure, obesity)	1 gm IV/IM q24h. Decrease to 500 mg IV/IM q24h if CrCl less than 30. Duration of treatment depends on specific infection. Pediatric (3 mon-12 years): 15 mg/kg IV/IM bid, maximum 1 gram/day.
Pregnancy, pediatrics issues	Category B
Relative cost	$40-50 per gram depending on the institution

Generic name	ERYTHROMYCIN
Proprietary name	Various
Class (generation)	Macrolide
MOA (bactericidal/bacteriostatic)	Bacteriostatic. Inhibits bacterial growth by suppressing RNA-dependent protein synthesis.
Spectrum (Gm+, Gm-, anaerobes)	Gm+ aerobes and atypicals (*Mycoplasma, Chlamydophila, Legionella*) No good for MRSA Poor for most Gram-negatives, no good for anaerobes
DOC for which diseases	Atypical pneumonia; diphtheria; pertussis; Alternative to amoxicillin for preventing bacterial endocarditis
Absorption, distribution, metabolism, excretion	Absorbed well from the fasting GI tract, distributed readily into most tissues except brain and CSF, excreted primarily in bile.
PD (time vs. concentration dependent killing)	Time-dependent killing
Side effects (what, how common, monitoring)	N/V/D, abdominal cramps (due to hemiketal metabolites formed in the gut); may prolong QTc interval (questionable significance)
Allergies	Rare
Drug interactions	**CYP 3A4 inhibitor**. Increases blood levels of benzodiazepines, carbamazepine, cyclosporine, ergot alkaloids, lovastatin, simvastatin, tacrolimus, pimozide
Dose (renal/hepatic failure, obesity)	Normal: 250-500mg po (or IV) q6h Possibly adjust dose for CrCl <10 Orally available as salt form and esters (be careful with doses)
Pregnancy, pediatrics issues	Pregnancy category B Pediatrics: safe
Relative cost	Generally inexpensive

Generic name	ETHAMBUTOL
Proprietary name	Myambutol
Class (generation)	Antimycobacterial agent
MOA (bactericidal/bacteriostatic)	Bacteriostatic
Spectrum (Gm+, Gm-, anaerobes)	*Mycobacterium* spp.
DOC for which diseases	Initial treatment of active TB (to cover resistance) Removed from therapy as soon as susceptibility to INH and RIF are confirmed
Absorption, distribution, metabolism, excretion	Poor CNS penetration regardless of inflammation Renal elimination
PD (time vs. concentration dependent killing)	Unknown
Side effects (what, how common, monitoring)	Most frequent toxicity: optic neuritis (dose-related). May result in changes in red-green color perception.
Allergies	Not common
Drug interactions	No significant interactions
Dose (renal/hepatic failure, obesity)	15-25 mg/kg/day Must adjust dose in renal dysfunction
Pregnancy, pediatrics issues	CDC says “safe” in pregnancy
Relative cost	Inexpensive

Generic name	GENTAMICIN
Proprietary name	Garamycin
Class (generation)	aminoglycoside
MOA (bactericidal/bacteriostatic)	Bactericidal, inhibits protein synthesis by binding with 30S ribosomal subunit.
Spectrum (Gm+, Gm-, anaerobes)	Aerobic gram-negative bacilli, *Pseudomonas aeruginosa*. Synergistic with cell-wall active drugs for G+ organisms. No anaerobic coverage.
DOC for which diseases	HAP (w/antipseudomonal β-lactam)
Absorption, distribution, metabolism, excretion	Poor oral absorption Vd = 0.26 L/kg; does not cross blood-brain barrier Relatively low concentrations in lung secretions Renally eliminated, T1/2 = 2-3 hours
PD (time vs. concentration dependent killing)	Concentration dependent killing
Side effects (what, how common, monitoring)	Nephrotoxicity (reversible), ototoxicity (irreversible), neuromuscular blockade at high concentrations
Allergies	None
Drug interactions	Increased nephrotoxicity with amphotericin B, cisplatin, cyclosporine, NSAIDs, vancomycin, radiographic contrast. Increased ototoxicity with cisplatin and loop diuretics. Increased apnea or respiratory paralysis with neuromuscular blocking agents.
Dose (renal/hepatic failure, obesity)	2 mg/kg load, then 1.7 mg/kg IV q8h Sarubbi-Hull dosing nomogram is very useful Peak = 5-8 mcg/ml (10-12 for pneumonia, <3 for G+) Trough = <1 mcg/ml Renal failure: adjust dose based on CrCl Obesity: Dose based on IBW + 0.4(TBW-IBW)
Pregnancy, pediatrics issues	Pregnancy Category D, may be used in pediatrics, Breastfeeding: infant risk minimal
Relative cost	Inexpensive

Generic name	IMIPENEM/CILASTATIN
Proprietary name	Primaxin
Class (generation)	Carbapenem
MOA (bactericidal/bacteriostatic)	Bactericidal, interferes with last stage of bacterial cell wall synthesis. **Excellent** β-lactamase resistance.
Spectrum (Gm+, Gm-, anaerobes)	Very broad spectrum: most gram positive, gram negative (including *Pseudomonas*), and anaerobes. Not Coag(-) staph or MRSA.
DOC for which diseases	Hospital acquired infections: high severity intraabdominal infections, hospital-acquired pneumonia
Absorption, distribution, metabolism, excretion	Not absorbed by GI tract. Given IV or IM. Hydrolyzed by dihydropeptidases present in brush border of renal proximal tubule to a toxic metabolite; therefore given with cilastatin, an inhibitor of these enzymes, to prevent breakdown. 70% excreted in urine as active drug. Half-life 1 hour.
PD (time vs. concentration dependent killing)	Time-dependent killing
Side effects (what, how common, monitoring)	N/V if infused too quickly. Increased potential for seizures if recommended doses exceeded in patients with CrCl less than 20 ml/min.
Allergies	Incidence of hypersensitivity is low. Potential for cross-reactivity with other β-lactams is about 50% for immediate hypersensitivity, 10% or less for accelerated hypersensitivity
Drug interactions	None
Dose (renal/hepatic failure, obesity)	500 mg q6h IV – adjust for renal failure. CrCl>50-90: 250-500 mg q6-8h CrCl 10-50: 250 mg q6-12h CrCl<10: 125-250 mg q12h
Pregnancy, pediatrics issues	Pregnancy category C, well tolerated in adults and children. Safety and efficacy of IM product not established in children under 12.
Relative cost	500 mg Primaxin: $33.10. One of the more expensive antimicrobials.

Generic name	ISONIAZID
Proprietary name	INH (abbreviation for isonicotinic acid hydrazide)
Class (generation)	Antituberculous agent, first line
MOA (bactericidal/bacteriostatic)	Bactericidal, mechanism unknown--possibly via inhibition of mycolic acid synthesis resulting in disruption of the cell wall
Spectrum (Gm+, Gm-, anaerobes)	*Mycobacterium tuberculosis*
DOC for which diseases	TB
Absorption, distribution, metabolism, excretion **CYP 2E1 inhibitor** **MAO inhibitor (weak)**	A-Rapid and complete; slowed with food D-distributes widely to all body tissues and fluids, including CSF; crosses placenta; enters breast milk M-mostly hepatic by acetylation E-Half-life: Fast acetylators:30-100 minutes Slow acetylators: 2-5 hours 75-95% excreted in urine; also in feces and saliva
PD (time vs. concentration dependent killing)	Not known
Side effects (what, how common, monitoring)	Hepatitis (monitor LFT baseline, 1, 3, and 6 months). Avoid ethanol. Peripheral neuropathy (give pyridoxine 25-50 mg qd).
Allergies	Not common
Drug interactions	Metabolic enzyme inhibitor (CYP2C19, CYP3A4). **Significance uncertain, don't fret too much about this.**
Dose (renal/hepatic failure, obesity)	5 mg/kg/day (max 300 mg qd). Duration depends on clinical situation.
Pregnancy, pediatrics issues	Pregnancy category C. Enters breast milk, compatible with lactation
Relative cost	Cheap: 300 mg tablets, 30/$9.84

Generic name	LEVOFLOXACIN
Proprietary name	Levaquin
Class (generation)	Fluoroquinolone
MOA (bactericidal/bacteriostatic)	Inhibits DNA gyrase and/or topoisomerase IV in susceptible organisms thereby inhibits relaxation of DNA and promote breakage. Bactericidal.
Spectrum (Gm+, Gm-, anaerobes)	Very good coverage of almost all Gram negatives; borderline for *Pseudomonas*. Decent *Streptococcus* coverage and non-resistant *S. aureus*. Active vs. *Enterococcus* if in the urine. Poor anaerobic coverage, not reliable for MRSA.
DOC for which diseases	CAP/HAP; UTI in elderly and where *E. coli* is >20% TMP/SMX resistant; bacterial sinusitis if exposed to antibiotics one month prior
Absorption, distribution, metabolism, excretion	Oral: bioavailability=99% Distribution: Vd:1.25L/kg, CSF conc. about 15% of serum levels, high concentrations in prostate, lung, gynecological tissues, sinus, saliva Metabolism: minimal Excretion: primarily urine as unchanged drug, half-life 6-8 hours
PD (time vs. concentration dependent killing)	Concentration dependent (AUC/MIC correlates best)
Side effects (what, how common, monitoring)	Gastrointestinal: diarrhea, nausea Neurologic: confusion, headache Cardiovascular: QTc prolongation (rare) Endocrine: hypoglycemia (in diabetic patients, rare) Musculoskeletal: rupture of tendon (rare) Acute interstitial nephritis (rare)
Allergies	Skin rashes occur now and then (generally uncommon)
Drug interactions	Avoid use of metal cations (e.g. aluminum, magnesium)
Dose (renal/hepatic failure, obesity)	Normal: 500 mg IV/PO qd (UTI: 250 mg PO qd) CrCl between 10-50: 500 mg x1, then 250 mg q24-48h CrCl <10: 500 mg x1 then 250 mg q48h Depending on the situation, 750 mg levofloxacin qd x5 days can be used (CAP, ABS)
Pregnancy, pediatrics issues	Not approved for pediatric use; pregnancy category C
Relative cost	Moderately priced

Generic name	LINEZOLID
Proprietary name	Zyvox
Class (generation)	Oxazolidinone
MOA (bactericidal/bacteriostatic)	Inhibits bacterial growth by preventing formation of 70s initiation complex, which inhibits protein synthesis, Bacteriostatic.
Spectrum (Gm+, Gm-, anaerobes)	Gram +: yes, including MRSA, PNSP, and VRE Gram -: not useful Anaerobes: some, not especially useful here
DOC for which diseases	VRE In addition, linezolid is looking better and better for certain MRSA infections, especially pneumonia
Absorption, distribution, metabolism, excretion	Absorption: very good Metabolism: 2 major metabolites Excretion: mostly in urine (~80%)
PD (time vs. concentration dependent killing)	Time-dependent killing
Side effects (what, how common, monitoring)	N/V, diarrhea, headache Reversible thrombocytopenia, anemia, neutropenia (the blood dyscrasias mainly occur in patients who receive >2 weeks of treatment)
Allergies	Rare
Drug interactions	Weakly and reversibly inhibits monoamine oxidase (MAO); may interact with dietary tyramine and SSRIs (possible serotonin syndrome) Adrenergic agents: risk of hypertension
Dose (renal/hepatic failure, obesity)	600 mg PO (or IV) BID X10-14d (adult) 10 mg/kg q8h (pediatric) Renal failure: no adjustment necessary
Pregnancy, pediatrics issues	Pregnancy category C, safe in pediatrics
Relative cost	Expensive!

Generic name	MEROPENEM
Proprietary name	Merrem
Class (generation)	Carbapenem
MOA (bactericidal/bacteriostatic)	CIDAL, inhibition of cell wall synthesis; readily penetrates the cell wall of most Gm+ and Gm- bacteria to reach PBP targets
Spectrum (Gm+, Gm-, anaerobes)	Good Gm+, good Gm-, Good anaerobic coverage No MRSA coverage, *Pseudomonas* YES In general, a bit more potent than imipenem for Gm- but a bit less potent than imipenem for Gm+
DOC for which diseases	HAP (empiric) Severe diverticulitis, perirectal abscess, peritonitis Sinusitis (hospitalized + intubation-related) Malignant otitis externa BOTTOM LINE: can be used for anything imipenem can be used for
Absorption, distribution, metabolism, excretion	Penetrates well into most tissues including CSF Largely eliminated unchanged in the urine Half-life 1 hour
PD (time vs. concentration dependent killing)	Time-dependent
Side effects (what, how common, monitoring)	Rash, thrombocytopenia, nausea/vomiting, diarrhea, headache (all less than imipenem)
Allergies	Have occurred in patients with hypersensitivities to β lactam antibiotics (the pattern is assumed to be like imipenem)
Drug interactions	Probenecid (inhibits renal excretion of meropenem) Oral contraceptives (the usual antibiotic-OC risk)
Dose (renal/hepatic failure, obesity)	Normal dose is 0.5-1.0 gm IV q8h 2 gm IV q8h for meningitis Adjust in renal insufficiency
Pregnancy, pediatrics issues	Pregnancy category B Lactation: unknown if excreted in breast milk (probably isn't)
Relative cost	Comparable to imipenem

Generic name	METRONIDAZOLE
Proprietary name	Flagyl
Class (generation)	Nitroimidazole
MOA (bactericidal/bacteriostatic)	Bactericidal; causes disruption of DNA helix and strand breakage leading to inhibition of protein synthesis and cell death
Spectrum (Gm+, Gm-, anaerobes)	**Anaerobes**, protozoa, *H. pylori*. **No activity against aerobic bacteria.**
DOC for which diseases	Trichomoniasis, *C. difficile* colitis, bacterial vaginosis, anaerobic infections
Absorption, distribution, metabolism, excretion	A-Well absorbed D-distributes to saliva, bile, seminal fluid, breast milk, bone, liver, lung and vaginal secretions, crosses placenta, and BBB. M-30-60% hepatic E-Half-life: 6-8 hr 20-40% excreted unchanged in urine; 6-15% in feces
PD (time vs. concentration dependent killing)	Unclear
Side effects (what, how common, monitoring)	Nausea, vomiting, metallic taste Disulfiram reaction (alcohol)
Allergies	Very rare
Drug interactions	2C9 inhibitor--potential interactions with warfarin and phenytoin
Dose (renal/hepatic failure, obesity)	500 mg PO tid x 10-14 days (*C. difficile* colitis) 2 g PO x 1 (*Trichomonas*) 500 mg po bid x 7 days (bacterial vaginosis) 500 mg IV q8h (serious anaerobic infection) Dose reduction recommended if CrCl <10
Pregnancy, pediatrics issues	Safe in pregnancy (B)
Relative cost	Cheap

Generic name	MOXIFLOXACIN
Proprietary name	Avelox
Class (generation)	3rd generation fluoroquinolone
MOA (bactericidal/bacteriostatic)	Bactericidal – inhibits topoisomerase II (DNA gyrase) and topoisomerase IV Attacking dual targets with roughly equal affinity may give moxifloxacin an advantage over levofloxacin in terms of causing resistance Bulky C-7 group helps to avoid bacterial efflux
Spectrum (Gm+, Gm-, anaerobes)	Excellent gram-positive coverage Not as great gram-negative coverage Anaerobe coverage is good (unproven though)
DOC for which diseases	Can be used in ABS if recent antibiotic use CAP patients with co-morbid conditions
Absorption, distribution, metabolism, excretion	90% bioavailability Absorbed in the gut Widely distributed throughout body Mainly eliminated by the liver (conjugation)
PD (time vs. concentration dependent killing)	Concentration-dependent (AUC/MIC correlates best)
Side effects (what, how common, monitoring)	Can prolong the QT interval (usually insignificant); has other typical FQ side effects; overall well tolerated
Allergies	Rare
Drug interactions	Avoid antacids
Dose (renal/hepatic failure, obesity)	400 mg PO qd (no adjustment in renal insufficiency)
Pregnancy, pediatrics issues	Pregnancy category C Not approved in pediatric patients
Relative cost	More expensive compared to ciprofloxacin and levofloxacin

Generic name	NAFCILLIN
Proprietary name	Unipen
Class (generation)	Penicillinase-resistant penicillin
MOA (bactericidal/bacteriostatic)	CIDAL. Penicillinase-resistant inhibitor of biosynthesis of mucopeptide (peptidoglycan). Most effective when bacteria are growing (subject to the inoculum effect)
Spectrum (Gm+, Gm-, anaerobes)	Ok Gm+, but really no Gm- or anaerobic coverage **(NO MRSA)**
DOC for which diseases	Osteomyelitis (MSSA) Brain abscess Mastoiditis (outpatient) Staphylococcal endocarditis (MSSA) Anything *S. aureus* that is MSSA Cellulitis, erysipelas Toxic shock syndrome
Absorption, distribution, metabolism, excretion	Distributes to most tissues readily where there is inflammation Excretion: metabolized. **NO ADJUSTMENT FOR RENAL DYSFUNCTION.**
PD (time vs. concentration dependent killing)	Time-dependent killing
Side effects (what, how common, monitoring)	Fever, rash, neutropenia (monitor WBC); all relatively rare
Allergies	Patients who are truly penicillin-allergic should be assumed nafcillin-allergic
Drug interactions	Decreases the anticoagulant effect of warfarin (mechanism unclear; CYP3A induction suggested, although CYP3A catalyzes only a minor R-warfarin metabolic pathway)
Dose (renal/hepatic failure, obesity)	Normal: 1-2 gm q4h IV, IM Renal failure: no reduction generally needed Hepatic failure: adjust empirically if dysfunction is severe
Pregnancy, pediatrics issues	Pregnancy category B Excreted into breast milk in small quantities (not clinically significant)
Relative cost	1 gm ~$5.63

Generic name	NITROFURANTOIN
Proprietary name	Macrobid, Macrodantin
Class (generation)	Synthetic nitrofuran
MOA (bactericidal/bacteriostatic)	Bactericidal at high conc, bacteriostatic at low conc. Inhibition of bacterial acetylcoenzyme A and subsequent disruption of the carbohydrate metabolism.
Spectrum (Gm+, Gm-, anaerobes)	Gm+: *S. aureus, Enterococcus* Gm-: *E. coli;* **be careful, many Gram-negatives are relatively resistant, e.g. *Proteus, Enterobacter*, *Klebsiella*** Anaerobes: no useful activity
DOC for which diseases	Alternative therapy for UTI (x7days) Occasionally used for longterm prophylaxis
Absorption, distribution, metabolism, excretion	Increased absorption with meal; highly protein bound and distributed throughout tissues; readily metabolized in tissues, renally excreted. **USE ONLY FOR URINARY TRACT INFECTION!**
PD (time vs. concentration dependent killing)	Concentration-dependent killing
Side effects (what, how common, monitoring)	N/V, pulmonary fibrosis, peripheral neuropathy, pseudotumor cerebri, intrahepatic cholestasis, hepatitis, and hemolytic anemia in G6PD deficiency. When given long-term, monitor for pulmonary, hepatic, and neurologic toxicity. These toxicities aren't necessarily common, but nevertheless physicians like to avoid them by choosing other agents.
Allergies	Rare
Drug interactions	Antacids can decrease the absorption of nitrofurantoin
Dose (renal/hepatic failure, obesity)	Macrodantin: 100 mg q6h x 7 days Macrobid: 100 mg bid x7 days Longterm UTI prophylaxis: 50-100 mg po qd **Contraindicated in renal failure (CrCl <50)**
Pregnancy, pediatrics issues	Pregnancy category B (but not for use in G6PD-deficient mothers)
Relative cost	Macrodantin:100mg generic $1.21 Macrobid: 100mg generic $2.26

Generic name	PENICILLIN G
Proprietary name	Various
Class (generation)	Natural penicillin (susceptible to penicillinase)
MOA (bactericidal/bacteriostatic)	Bactericidal. Inhibits cell wall synthesis by binding to PBPs.
Spectrum (Gm+, Gm-, anaerobes)	Gram +: good for *Streptococcus pyogenes* (GABS) but not active against *Staphylococcus* (neither MSSA nor MRSA). PNSP prevalence about 40% in the US. Gram -: useful for nonpenicillinase-producing species of *Neisseria* Usually effective for above-diaphragm anaerobes but not for below-diaphragm anaerobes
DOC for which diseases	**Acute pharyngitis** **ARF prophylaxis** **Syphilis, neurosyphilis**
Absorption, distribution, metabolism, excretion	Pen G: IV only 65% protein bound Crosses BBB if meninges are inflamed >80% excreted unchanged via kidneys Half-life: 30 minutes
PD (time vs. concentration dependent killing)	Time dependent
Side effects (what, how common, monitoring)	Diarrhea, serum sickness (rare)
Allergies	Immediate allergy: anaphylaxis (rare) Accelerated: urticarial rash Late: maculopapular rash
Drug interactions	Probenecid inhibits tubular secretion of penicillin which results in increased blood levels
Dose (renal/hepatic failure, obesity)	Acute pharyngitis: Bicillin LA 0.6 or 1.2 million units x1, depending on patient weight Neurosyphilis: Pen G 3-4 MU IV q4h x10-14d Dose reduction in renal failure
Pregnancy, pediatrics issues	Safe in pregnancy and pediatrics
Relative cost	Pen G: 5MU about $5-6

Generic name	PENICILLIN VK
Proprietary name	Various
Class (generation)	Natural penicillin (susceptible to penicillinase)
MOA (bactericidal/bacteriostatic)	Bactericidal. Inhibits cell wall synthesis by binding to PBPs.
Spectrum (Gm+, Gm-, anaerobes)	Gram +: good for *Streptococcus pyogenes* (GABS) but not active against *Staphylococcus* (neither MSSA nor MRSA). PNSP prevalence about 40% in the US.
DOC for which diseases	Acute pharyngitis
Absorption, distribution, metabolism, excretion	60-70% absorbed 65% protein bound >80% excreted unchanged via kidneys Half-life: 30 minutes
PD (time vs. concentration dependent killing)	Time dependent
Side effects (what, how common, monitoring)	Diarrhea, serum sickness (rare)
Allergies	Immediate allergy: anaphylaxis (rare) Accelerated: urticarial rash Late: maculopapular rash
Drug interactions	Probenecid inhibits tubular secretion of penicillin which results in increased blood levels
Dose (renal/hepatic failure, obesity)	**Acute pharyngitis**: 250 mg PO bid or tid (25-50 mg/kg/day) x10d
Pregnancy, pediatrics issues	Safe in pregnancy and pediatrics
Relative cost	Inexpensive

Generic name	PIPERACILLIN/TAZOBACTAM
Proprietary name	Zosyn
Class	ß-lactam/ß-lactamase inhibitor
MOA (bactericidal/bacteriostatic)	Bactericidal. Inhibits cell wall synthesis. Tazobactam is a β-lactamase inhibitor that inhibits some ß-lactamases (such as Bush class 2b enzymes, or the ESBLs) but NOT class 1 enzymes (from SPICE organisms)
Spectrum (Gm+, Gm-, anaerobes)	Broad: gram (+) and (-) including *Pseudomonas*, plus anaerobes
DOC for which diseases	**CAP**: with cipro for ICU pts at risk for *Pseudomonas* **HAP**: combined with gentamicin **Secondary peritonitis (all by itself)** Osteomyelitis in diabetes
Absorption, distribution, metabolism, excretion	Widely distributed throughout body Excreted mostly unchanged via kidneys Half-life of piperacillin: 1 hour
PD (time vs. concentration dependent killing)	Time dependent
Side effects (what, how common, monitoring)	Drug fever, rash, diarrhea
Allergies	Immediate allergy: anaphylaxis (rare) Accelerated: urticarial rash Late: maculopapular rash
Drug interactions	Nothing significant
Dose (renal/hepatic failure, obesity)	**"Standard" dose**: 3.375 g IV q6h (can also use 4.5 g q8h). This dose is not reliable for *Pseudomonas*, however, so be careful. Reduce dose in renal failure **IMPORTANT: 16-18 grams/day of piperacillin must be used whenever *Pseudomonas* is a concern (i.e. 3.375 g IV q4h or 4.5 gm IV q6h)**
Pregnancy, pediatrics issues	Category B
Relative cost	~$50 per day (standard dose)

Generic name	PYRAZINAMIDE
Proprietary name	PZA (abbreviation)
Class (generation)	Antituberculous agent
MOA (bactericidal/bacteriostatic)	Bactericidal in acid pH of macrophages
Spectrum (Gm+, Gm-, anaerobes)	***Mycobacterium tuberculosis***
DOC for which diseases	Active TB, first line (only used in combination with other drugs)
Absorption, distribution, metabolism, excretion	A: almost completely absorbed from GI tract D: 5-10% protein bound, Vd 0.75-1.65 L/kg, distributes into CSF well M: 15-30% E: Renal 70% Half-life: 9 hours
PD (time vs. concentration dependent killing)	Unclear
Side effects (what, how common, monitoring)	N/V, Hyperuricemia, arthralgia (40%), **severe liver injury** Monitor LFTs, serum uric acid levels
Allergies	Not commonly reported
Drug interactions	Not well defined
Dose (renal/hepatic failure, obesity)	TB: 25-30 mg/kg/day Renal dosing: consider decreasing dose by 50% if CrCl less than 10
Pregnancy, pediatrics issues	Pregnancy category C, safe in pediatrics
Relative cost	Inexpensive

Generic name	RIFAMPIN
Proprietary name	Rimactane
Class (generation)	Rifamycin
MOA (bactericidal/bacteriostatic)	Bactericidal drug Binds to bacterial DNA-dependent RNA polymerase
Spectrum (Gm+, Gm-, anaerobes)	**M. tuberculosis** Excellent for *S. aureus* (including MRSA) and *S. epidermidis* **but only in combination with another drug**
DOC for which diseases	First line for TB PVE Chemoprophylaxis for *N. meningitidis* meningitis
Absorption, distribution, metabolism, excretion	A: 90-95% GI absorbed, delayed by food D: 60-90% protein bound, rapidly distributed into tissues, penetrate abscesses and CSF (if inflamed) Vd: 0.9 L/kg M: Liver 60-80%, enterohepatic circulation E: Renal 15-30%, Bile, Feces 60%
PD (time vs. concentration dependent killing)	Not established
Side effects (what, how common, monitoring)	GI upset is common, colors body fluids orange; routinely causes hyperbilirubinemia (usually transient); hemolytic anemia, renal failure, thrombocytopenia (1%) especially in patients who receive intermittent therapy (get baseline CBC, liver enzymes, SCr)
Allergies	Uncommon
Drug interactions	**Makes oral contraceptives unreliable** **Potent inducer of CYP 1A2, 2C9, 2C19, 3A4**
Dose (renal/hepatic failure, obesity)	TB dose: 10 mg/kg/day (maximum 600 mg qd) Meningococcus prophylaxis: 600 mg PO bid x2 days PVE: 300 mg PO q8h Adjunct drug for *S. aureus*: 300 mg PO q8-12h Renal: consider a dosage change if CrCl <50 Hepatic: decrease dose if severe dysfunction
Pregnancy, pediatrics issues	Pregnancy category C, ok in pediatrics
Relative cost	Inexpensive

Generic name	TELITHROMYCIN
Proprietary name	Ketek
Class (generation)	Ketolide
MOA (bactericidal/bacteriostatic)	Bacteriostatic; binds to 2 sites on 23S ribosome (macrolides bind to only one); also avoids drug efflux
Spectrum (Gm+, Gm-, anaerobes)	G+: especially good for drug resistant *S. pneumoniae, S pyogenes* G-: M cat and H flu Unreliable for MRSA Not good for anaerobes **SUMMARY: the "best" of azithro plus the "best" of clarithro rolled into one drug, with the added advantage of covering drug-resistant *S. pneumoniae***
DOC for which diseases	Indicated for CAP, AECB, sinusitis
Absorption, distribution, metabolism, excretion	A: oral 57% bioavailability, unaffected by food D: 60-70% protein bound, penetrates lung tissues well, Vd=2.9 L/kg M: 37% in liver (50% CYP metabolized) E: 75% feces, Renal 12-14%. Half-life 10 hours.
PD (time vs. concentration dependent killing)	Concentration dependent, prolonged post antibiotic effect
Side effects (what, how common, monitoring)	Diarrhea (10%), nausea (7%), headache (5%), dizziness (4%), vomiting (3%) **Liver dysfunction (rare)** Visual disturbances can be serious
Allergies	Hypersensitivity to ketolide or macrolide antibiotics
Drug interactions	Competitive inhibitor of CYP 3A4 and 2D6
Dose (renal/hepatic failure, obesity)	Usual: 800 mg PO qd x5 days (7-10 days for CAP) Renal dosing: 400 mg PO qd if CrCl <30
Pregnancy, pediatrics issues	Pregnancy category C Pediatrics safety not yet established (no suspension form available)
Relative cost	Expensive, overpriced (at least initially)

Generic name	TIGECYCLINE
Proprietary name	Tygacil
Class (generation)	Glycylcycline (derived from minocycline)
MOA (bactericidal/bacteriostatic)	Bacteriostatic: inhibits protein translation by binding to the 30S ribosomal subunit
Spectrum (Gm+, Gm-, anaerobes)	**Most** Gm+ (including MRSA, VRE, PNSP) Many Gm- (not *Proteus* spp. or *Pseudomonas*) Anaerobes: pretty good below-the-diaphragm Tigecycline is not affected by the 2 major tetracycline resistance mechanisms: ribosomal protection and efflux
DOC for which diseases	**Alternative** treatment for complicated skin and skin structure infections as well as intraabdominal infections
Absorption, distribution, metabolism, excretion	Metabolism / Excretion: not extensively metabolized. 59% of the dose is eliminated by biliary/fecal excretion, and 33% is excreted in urine. Approximately 22% of the total dose is excreted as unchanged tigecycline in urine. Half-life LONG: 30-36 hours.
PD (time vs. concentration dependent killing)	Concentration-dependent (AUC/MIC)
Side effects (what, how common, monitoring)	Significant nausea, vomiting and diarrhea. Tooth discoloration: the use of tigecycline during tooth development (last half of pregnancy, infancy, and childhood until the age of 8 years) may cause permanent discoloration of the teeth (yellow-gray-brown).
Allergies	No major issues
Drug interactions	May decrease warfarin clearance (significance unclear)
Dose (renal/hepatic failure, obesity)	100 mg IV x1, then 50 mg IV q12 hours (x10-14 days) NO adjustment in renal dysfunction In severe hepatic impairment, the initial dose of tigecycline should be 100 mg, then 25 gm IV q12h
Pregnancy, pediatrics issues	Pregnancy Category D; safety in pediatrics has not been established
Relative cost	About $90/day (similar to linezolid)

Generic name	TRIMETHOPRIM/SULFAMETHOXAZOLE (TMP/SMX)
Proprietary name	Bactrim, Septra
Class (generation)	Sulfonamide plus DHFR inhibitor
MOA (bactericidal/bacteriostatic)	Bacteriostatic: SMX inhibits dihydropteroate synthetase, TMP inhibits dihydrofolate reductase
Spectrum (Gm+, Gm-, anaerobes)	Gm+: good for CA-MRSA, but usually does not work for PNSP and does not cover *Enterococcus*, *S. epidermidis,* or GABS Gm-: generally effective for enteric GNR, *H. influenzae;* does not cover *Pseudomonas* Anaerobes: inactive
DOC for which diseases	UTI (unless *E. coli* resistance is >20%) SBP prophylaxis PCP in AIDS patients
Absorption, distribution, metabolism, excretion	Absorption: 90-100% Vd: TMP 2.0 L/kg; SMX 360 mL/kg; penetrates CSF Half-life: 10-12 hr (each component) Metabolism: extensive liver metabolism Renal excretion: SMX 10-30%; TMP 50-75%
PD (time- or concentration-dependent killing)	Unclear
Side effects (what, how common, monitoring)	10% of patients: N/V/GI upset; skin problems (rash, urticaria, photosensitivity); hyperkalemia Less common: Stevens-Johnson syndrome, toxic epidermal necrolysis. Can cause blood dyscrasias, especially in AIDS patients. Commonly suspected cause of aseptic meningitis.
Allergies	Sulfonamide allergy is common
Drug interactions	SMX is a CYP2C9 inhibitor
Dose (renal/hepatic failure, obesity)	UTI: 1 DS tablet BID PCP: 5 mg/kg q6-8h (based on TMP component) Reduce dose by 50% if CrCl <50 ml/min
Pregnancy, pediatrics issues	Pregnancy category C but do not use near term; safe for use in pediatrics but do not use in children < 2 months old due to possibility of kernicterus
Relative cost	Very inexpensive

Generic name	VANCOMYCIN
Proprietary name	Vancocin
Class (generation)	Glycopeptide
MOA (bactericidal/bacteriostatic)	Bactericidal: inhibits cell wall synthesis by binding to D-ala-D-ala dipeptides
Spectrum (Gm+, Gm-, anaerobes)	Gm+: active against most genera (should be combined with an aminoglycoside to treat *E. faecalis*) No Gm- activity Anaerobic activity: *C. difficile* (oral only)
DOC for which diseases	MRSA infections Bacterial meningitis (combined with ceftriaxone) Vascular catheter infections due to *S. epidermidis* Endocarditis (second line) Antibiotic-associated diarrhea (second line)
Absorption, distribution, metabolism, excretion	A: not orally absorbed D: wide, including CSF if meninges are inflamed; Vd 0.7 L/kg M: not metabolized E: excreted unchanged in the urine (half-life 6 hours)
PD (time vs. concentration dependent killing)	Time-dependent killing
Side effects (what, how common, monitoring)	Rapid infusion can cause "red man syndrome" (flushed skin, edema) Neutropenia (rare) Rash (rare) Ototoxicity and nephrotoxicity (rare)
Allergies	Not a particular issue with this drug
Drug interactions	Increased frequency of nephrotoxicity with aminoglycosides
Dose (renal/hepatic failure, obesity)	Normal dose: 1 gm IV q12h Obesity: daily dose correlates with actual body weight Renal dysfunction: increase dosing interval as CrCl decreases
Pregnancy, pediatrics issues	Pregnancy category C, safe to use in pediatrics
Relative cost	Somewhat expensive