**Gompf’s**

**Antibiotics**

**Redux**

**A Pocket Tool for the Medical Student, or Resident on the Infectious Diseases Clinical Rotation**

**or**

**Just about anyone who could use a pocket antibiotic tool**

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**ANTIBIOTIC PEARLS**

1. Penicillins generally cover Gram +s, anaerobes, certain Gram –s depending on the antibiotic.

2. Cephalosporins generally cover Gram +s (EXCEPT Enterococcus!), Gram –s, few or NO anaerobes. ONLY ceftazidime/cefepime cover Pseudomonas. They do not cover SPACEK/SPICE**\*** Gram negatives reliably; ceftriaxone/cefepime may be fine in less serious infections.

3. Aztreonam, a monobactam, covers ONLY Gram –s, incl. Pseudomonas. Reserve for beta lactam-allergic patients.

4. Aminoglycosides generally cover Gram +s (except tobramycin) & Gram –s, NO anaerobes, some Mycobacteria.

5. Quinolones cover Gram –s best (except moxifloxacin, best for respiratory Gram +s & anaerobes), some Mycobacteria.

6. Sulfas generally cover some Gram +s/MRSA, Nocardia, Listeria, Pneumocystis, most Gram –s except Pseudomonas.

7. Clindamycin generally covers Gram +s, incl anaerobes except Clostridia, like anaerobic/microaerophilic Strep/Peptostrep, Actinomyces (better for infections above the diaphragm).

8. Metronidazole generally covers Gram— anaerobes like Bacteroides, Prevotella, Clostridia; +/-Peptostrep (better for infections below the diaphragm).

9. Carbapenems are Big Gun Beta Lactams & Expensive. Use sparingly. Ertapenem covers most organisms except Pseudomonas. Imipenem, meropenem, & doripenem include Pseudomonas. Resistance in one carbapenem doesn’t predict resistance in others.

10. Keys to Antibiotics for Resistant Gram +s: Vancomycin, teichoplanin (Europe) cover all but vancomycin-resistant Gram +s; daptomycin, linezolid, quinupristin-dalfopristin are VERY EXPENSIVE ($100+ a day) & generally reserved for vancomycin-resistant Gram +s. Vancomycin is bacteriCIDAL, except bacterioSTATIC in Enterococcus. Daptomycin & quin-dalfo are CIDAL. Linezolid & tigecycline are bacterioSTATIC, NOT the right choice for bacteremia unless no other options are possible, and best not as monotherapy. Tigecycline is associated with higher mortality than comparators for FDA-approved indications in after-market review of pooled clinical trials.

Shameless plug:

Visit [www.gompfsidpearls.net](http://www.gompfsidpearls.net) for more regularly updated ID clinical tools & links I find useful in practice. :}

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**Do’s & DON’Ts**

1. ***Don’t use an antibiotic if you don’t need to.***
2. If a bacterial infection is not high in the differential and the patient is not clinically toxic, forgo antibiotics. They are poor antipyretics.
3. ***Persistent fevers require work-up, not more antibiotics.***
4. If you are treating with broad antibiotics and fevers persist, stop them; they aren’t helping anyway.
	* Look for undrained foci of infection/pus 🡪 drain it.
	* Look for non-infectious cause 🡪 treat it.
	* True FUO in a rapidly deteriorating patient may warrant empiric anti-TB therapy 🡪 Call ID.
5. ***DO use an oral antibiotic when you can; use one narrow antibiotic when you can; stop antibiotics when you can.***
	* Antibiotics are not cheap; switch to PO when reasonable.
	* Two antibiotics don’t usually prevent resistance better than one, and neither do broad spectrum drugs. More drugs = more resistance opportunities. Yet multi-drug synergy *is* desirable in:
	* Pseudomonas sepsis/SIRS: May consider antipseudomonal PCN + 1 dose 5mg/kg IV aminoglycoside.
	* Rifampin + vancomycin/tetracyclines/TMP-SMX/etc for some S. aureus infections – NEVER rifampin alone 🡪RAPID resistance
	* TB/Atypical mycobacteria: *NEVER* use 1 drug in *active* TB
	* Cryptococcosis: 5-flucytosine + amphoB
	* Molds, Fusarium: voriconazole + an echinocandin (caspofungin has most data) or lipid-based amphotericin OR lipid-based amphotericin + caspofungin/echinocandin
	* DON’t treat viral infections (or noninfectious syndromes) with antibiotics beyond the point at which you have ruled out bacterial infection.
	* NEVER give Rifampin alone! Rapid high-level resistance occurs. Use in combinations.
6. ***Always monitor for antibiotic adverse effects.***
7. Antibiotics are a double-edged sword. Respect them.
8. Watch for hypersensitivity/bone marrow suppression/interstitial nephritis/hepatotoxicity/drug fever with beta lactams, acute tubular necrosis/irreversible ototoxicity with aminoglycosides, & Clostridium difficile with almost all of them.
9. Watch for yeast overgrowth/Candidemia with prolonged/multiple antibiotic therapy.
10. C. diff. is easy to miss in 2 situations:
	* Colostomies – stumps/small bowel can be infected with C.diff.!
	* Spinal cord injured patients – unexplained abdominal distension & leukocytosis are a clue
11. RIFAMPIN REDUCES EFFECTIVENESS OF ORALCONTRACEPTIVES! Tell female patients to *add barrier contraception until the next new pill pack* after finishing antibiotics.

**Antifungal coverage in general:**

Fluconazole = Cryptococcus, Candida EXCEPT Candida krusei/glabrata

Itraconazole = Candida, Histoplasma, Crypto, Aspergillus

Voriconazole = Candida, Histo, Crypto, Aspergillus, Fusarium, NOT Mucor/Rhizopus

Posaconazole /isuvaconazole = same as vori, + Mucor/Rhizopus

Caspofungin/Micafungin/Anidulafungin (enchinocandins) = Candida, Aspergillus, NOT Fusarium/Mucor/Rhizopus, SOME Crypto

Amphotericin = all, +/- Fusarium, NOT Candida lusitaniae/guillermondi, NOT

Scedosporium (Pseudallescheria)

**Fusarium:** Vori 6mg/kg IV Q24H or 300mg PO x 1 d, then 4mg/kg/d IV or 200mg PO BID + Ampho B 1.2 mg/kg/d or ABLC 5mg/kg/d

**Mucor:** Ampho B 1.5mg/kg/d or liposomal ampho B or ABLC 5mg/kg/d + posaconazole/isuvaconazole; NOT other azoles/enchinocandins

DON’T USE Ampho + itra/keto = ANTAGONISTIC.

5FC increases penetration of above drugs.

**BacteriCIDAL vs. BacterioSTATIC**

A consideration in choosing treatments for serious infection like sepsis or bacteremia of meningitis, pneumonia, endocarditis, osteomyelitis, neutropenic fever. A “cidal” drug kills quickly; a “static” drug slows or stops replication and/or toxic production.

***Beta lactams are CIDAL and penetrate tissues and inflamed meninges well.*** They are preferable in serious infection, including bacteremia, endovascular infection, CNS infection, and streptococcal cellulitis. Their microbial action is time-dependent, meaning that they are most effective the longer the concentration of drug in the affected site remains above the MIC of the bacteria. Thus, they can be dosed by continuous or extended infusion, which may also facilitate home infusion. (Google Johns Hopkins Continuous Antibiotic Infusion for their helpful guide; most drug databases don’t offer alternative dosing recommendations.) Some are also stable enough to be given 3 times a week after hemodialysis.

**SPICE/SPACEK are mnemonics for bacteria that are often beta lactam resistant or prone to developing it:**

**SPACEK**

**S**erratia

**P**seudomonas/indole + Proteus

**A**cinetobacter

**C**itrobacter

**E**nterobacter/**E**.coli

**K**lebsiella

**SPICE**

**S**erratia

**P**seudomonas

**I**ndole + Proteus

**C**itrobacter

**E**nterobacter/E.coli

These organisms may all demonstrate resistance to commonly prescribed beta lactams and may require carbapenem\* treatment. The SPACE organisms may produce inducible chromosome-based broad-spectrum beta lactamases as part of the Enterobacteriacae group, and resistance/failure may be induced during beta lactam treatment, even though they initially test susceptible. E. coli and Klebsiella are the most common extended spectrum beta lactamase (ESBL) producers, so many labs screen those isolates if MIC for ceftazidime is >/= 2 microG/mL. Just remember that most Enterobacter should be suspect for ESBLs, & may require carbapenem treatment. Remember that **Klebsiella** also has a constitutive (or inherent) chromosome-based beta lactamase that confers resistance to ampicillin/ticarcillin, so these drugs are never a good choice for this bacterium. Preferred treatment in serious infection is a carbapenem.

\*Note that carbapenems and the monobactam, aztreonam *are* beta lactams, as they all have a beta lactam ring. This may be confusing initially when you read about beta-lactam resistance and recommendations to use a beta lactam (carbapenem); many references gloss over this, and clinically we often use carbapenems as if they’re a completely different animal.

**Which antibiotics are bacteriostatic?**

In sepsis, restore **V**olume with a **L**iter of **ST**AT **NML** (normal)saline.

**V**ancomycin in Enterococcus; cidal for all other GPCs

**L**inezolid

**S**ulfas/trimethoprim

**T**etracyclines/**T**igecycline

(at)

**N**itrofurantoin

**“ML**S antibioticgroup” – clindamycin, macrolides (the streptogramins are bactericidal)

Everything else is bactericidal & probably better for sepsis and serious infections!

*Note bene:* Clindamycin is used as an adjunct for Staph or Strep toxic shock, severe streptococcal cellulitis or suspected necrotizing infection; it halts protein synthesis—i.e stops production of toxins that mediate severe inflammation, necrosis, and toxic shock. Many Staphylococcus aureus strains carry inducible clindamycin resistance genes, so I suggest having susceptibilities available before relying on clindamycin alone for this pathogen. You can also use linezolid, doxycycline/minocycline/tigecycline for toxin-inhibition in severe Staph infection.

**THE CLASSES (not an exhaustive list)**

**Penicillins** – beta lactams are CIDAL, good tissue penetration

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| --- | --- | --- | --- | --- |
| **DRUG** | **COVERAGE** | **USES** | **TOXICITY** | **Cerebral Spinal Fluid (CSF)** |
| **penicillin G**$CIDAL | Group A Strep (no resistance)Strep viridansNeisseriaCapnocytophagiaActinomycesFusobacteriumClostridia perfringens/tetaniPasteurellaTreponema/LeptospirosisNOT Staph aureus (resistant) | Skin/soft tissue (SST) or mouth infections | Hypersens-itivityStevens JohnsonInterstitial nephritisSeizures (if high level)Bone marrow suppress-ionC.difficile | YES if inflamed |
| **AminoPCN**$$ amoxicillin\*ampicillin\*amox/clavuamp/sulbactCIDAL | Add to the above:ListeriaMSSAMost PneumococcusProteusHemophilus influ. (beta lactamase negative)Salmonella/ShigellaAnaerobes*\* Klebsiella are intrinsically resistant to amp/amox* (clavulanate/sulbactam don’t add much activity) | Otitis mediaSinusitisSSTMeningitis in elderly | Above |
| **CarboxyPCN**$$ticarcillin/clavulanatepiperacillinpiperacillin/tazobactam CIDAL | Adds to the above:PseudomonasEnterobactersStenotrophomonas (ticar)Gut anaerobesMSSAPip & Pip/tazo more potent for GNRs | Adds to above:Gut/surgical infectionsNosocomial pneumoniaProstateOsteomyel-itis | Above |

**Cephalosporins** – Think of progressive broadening of spectrum from Gram + to Gram - with each generation. Beta lactams are CIDAL.

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| --- | --- | --- | --- | --- |
| **DRUG** | **COVERAGE** | **USES** | **TOXICITY** | **CSF** |
| **1st Generation**$$cefalothincefazolinCIDAL | GPC, E. coli, Proteus, KlebsiellaNOT Enterococci | SSTIUncomplicated/Non-diabetic OsteomyelitisPreOP prophylaxis | Hypersens-itivityBone marrow suppression DiarrheaC.difficile |  POOR |
| **2nd Generation**$$cefuroxime (IV/PO)cefaclor (PO)Cefamycins:cefoxitin (IV)cefotetan (IV) | GPCPneumococc-usNeisseriaSome GNR except PseudomonasCefamycins add anaerobesNOT Enterococci | Community acquired pneumonia (CAP)meningitisOM/sinusitisGonorrhea | Hypersens-itivityRASH/Stevens Johnson w/ cefaclorHigh INR/PT w/ cefoxitin/cefotetanBone marrow suppressionC.difficile | YES if inflamed |
| **3rd Generation**$$ceftriaxone (QD dosing)cefotaximeceftazidime CIDAL | Above, plus Pseudomonas for ceftazidime | MeningitisCAPMost community-acquired infectionsGonorrheaPyelonephritis  | Above |
| **4th Generation**$$cefepimeCIDAL | Above, plus PseudomonasResists beta lactamases/ESBLsLess freq dosing than ceftazidimeNOT Enterococci | Above, plus neutropenic fever | Above |
| **Anti-MRSA**$$$ceftarolineCIDAL | Similar to 3rd generation, plus MRSA, VISA/VRSAVRE faecalis (NOT E. faecium), pneumococc-us, beta-lactamase + H.flu/Moraxella | Complicated SSTI, CAP (NOT MRSA-insufficient data) | Above |
| **Advanced-generation**ceftolazane-tazobactamceftazidime-avibactamCIDAL | NOT Enterococci or Staphylococciceftolaz-taz covers GNRs incl Pseudomonas, ESBLs, NOT carbapenemscaz-avi covers KPC+ carbapenemase (1st line agent)caz-avi covers GNRs incl Pseudomonas, adds coverage for ceftaz-R, ESBLs, some ampC-R, some carbapenemases (NOT metallobetalactamase) | Complicated UTI/pyelo Complicated intraabdominal infection caz-avi adds HAP | Above Nausea, diarrhea, headache, fever, renal insufficiency (ceftolazane-t) | ceftazidime – YES if inflamed (NOT avibactam)ceftoazane – UNKNOWN |

**Monobactam**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY** | **CSF** |
| aztreonam$$CIDAL | GNRs only | GNR infectionsNOT a replacement for all aminoglyco-side uses (no synergy for GPC, NO Enterococcal coverage) | Low | YES if inflamed [Modal J et al. AAC. 1986;29:281-3.] |

**Carbapenems (Reserved for Multidrug Resistant Organisms – MDRO)**

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| --- | --- | --- | --- | --- |
| **DRUG** | **COVERAGE** | **USES** | **TOXICITY** | **CSF** |
| imipenem/cilastinmeropenemmeropenem-vaboractam$$$ | Gram +s EXCEPT MRSAGram –s EXCEPT Stenotrophomonas/BurkholderiaESBL+& ”SPICE” GNRAnaerobes (incl Cutibacteirum)ListeriaPneumococcusNocardia asteroides (NOT brasiliensis)LegionellaMycobacterium avium+/- Enterococcusmero-vaboractam adds *carbapenemase+ Klebsiella pneumonia (KPC)*, class A carbap-R Enterobacteraciae (NOT metallobetalactamase/OXA carbap-R, NOT carbap-R Pseudomonas/Acinetobacter) | Resistant GNR infectionsSerious gut infectionsNecrotizing pancreatitis | IV/IMHypersensit-ivity(~10% cross-allergy with beta lactams)Seizures (if renal insufficiency or high levels used) with imipenemCandida overgrowth/infectionsC.difficileEncephalo-pathy | YES |
| doripenem$$$CIDAL | Above, possibly lower MICs to Pseudomonas & Acinetobacter | Above | Above |
| ertapenem$$$CIDAL | Above, without Pseudomonas coverage | Postpartum uterine infectionsPostsurgical Abdominal infections (not Pseudomo-nas) | Above |

**Aminoglycosides**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/****MISC** | **CSF** |
| gentamicinstreptomycinspectinomycintobramycin amikacinliposomal amikacin$-$$$CIDAL | Gent: GPCs & GNRs incl PseudomonasTobra/Amik: GNRs incl PseudomonasAmik: Mtb, NTMStrepto -Yersinia -MDR Mtb Gent/Strept-Tularemia Spectino-Gonorrhea  | Synergy with beta lactams for GPC/Pseud-omonas infections Usually not used alone except for UTIs | IV/Aerosol Acute tubular necrosis (reversible)Ototoxicity/Vestibular toxicity (irreversible)When possible:-stop after 3-5 d-use once-daily dosing-avoid in elderly Liposomal amik – hypersensitivity pneumonitis, hemoptysis, bronchospasm, exacerbation of lung disease Neuromuscular blockade (may exacerbate myasthenia gravis & paralytic agents) | NO-UNKNOWN |
| fosfomycin $$CIDAL | EnterococcusGNRs | Simple cystitis in womenOff-label q3days for complicated or MDR GNRs, VRE if susceptible | PO onlyAbove, significant diarrhea |
| plazomicin $$ CIDAL | GNRs incl MDR/KPC/metalobetalact/CRE GNRs,variable Pseudomonas (use only if known susceptible), NOT Steno, Acinetobacter | Complicated UTI/pyelo | IV onlyAboveLimited data |

**Sulfonamides/Sulfas**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/MISC** | **CSF** |
| trimethoprim-sulfamethoxazole co-trimoxazole$STATIC for Staph | Staph. aureus (incl MRSA)LegionellaStenotroph-omonasListeriaPneumo-cystisNocardia Burkhold-eria cepaciaYersiniaFrancisella tularensisSome common coliforms | UTIMRSA SSTISpecific agents at left | IV/PORASH/Stevens JohnsonElevated creatinine or K+(competes with Cr for tubular secretion, blocks K+ excretion)Kernicterus in neonatesC.difficileSun sensitivity | YES |

**Macrolides/Lincosamides (Macrolide-Lincosamide-Streptrogramin B class, or MSL—all bind 50s ribosome subunit & share resistance genes)**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/MISC** | **CSF** |
| **Macrolides**erythromycinclarithromycinazithromycin$$STATIC | Pneumo-coccusMSStaph. aureus (not MRSA)LegionellaListeriaNeisseria meningitisHemophilusMoraxellaMycoplasmaChlamydiaActinomycesAtypical mycobacteria | LRTI/bronchitisSinusitisDental/oral infectionsAtypical mycobac-teria(incl MAC prophy in HIV) | IV/PONausea/vomitingAbdominal cramps/diarrhea (Lowest with Azithro)C.difficileOtotoxicity with chronic useRare association with cardiovascular mortality with QTc prolongation, low Mg++/K+. Interactions: Ery/Clari induce P450!Neuromuscular blockade with Ery (may exacerbate myasthenia gravis & paralytic agents) | POOR |
| **Lincosamides**clindamycin$$STATIC | CIDAL for Group A streptococc-us, MSStaph. aureus (MRSA, but watch for inducible *erm* resistance. Clue is resistance to erythromycin)Pneumo-coccusInhibits toxic proteins in severe Strep A & S. aureus/necrotizing fasciitis.Oral anaerobes: Gram + such as Peptostrepto-coccus, Fusobacter-ium, Prevotella, Actinomyces, & Clostridial spp other than Clostridium difficileGram – such as Bacteroides (may not cover in up to 25% of cases or strains with MIC >/= 8 mcg/mL)Babesiosis | Severe SSTI, necrotizing fasciitis, MRSA*“Infections above the diaphragm”*Head and neck/dental infectionsLung abscess/aspiration pneumonia (tip: no teeth = no oral anaerobes)Bacterial vaginosisBabesiosisToxoplasma in HIV |  IV/POC.difficile!! (>30% develop it on a week of clinda)Watch for hepatitis/obstructive jaundiceNeuromus-cular blockade (may exacerbate myasthenia gravis & paralytic agents) | POOR except for Toxo-plasmosis in HIV |

**Nitrofuran**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/MISC** | **CNS** |
| nitrofurantoin$ CIDAL | Gram –s EXCEPT Pseudomonas, Proteus, and Enterococcus incl susceptible VRE Multiple sites of action, inhibits synthesis of DNA, RNA, proteins, cell wall – higher resistance barrier than most antibiotics | UTI/CystitisONLY reaches therapeutic level in URINE | PO onlyNausea/vomitingC.difficile | NONE |

**Quinolones (Resistance is rising due to overuse)**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/MISC** | **CSF** |
| **“Gram negative”****Quinolones**ciprofloxacinlevofloxacinnorfloxacin$-$$CIDAL | Gram –s including Pseudomo-nasLevo covers pneumococcus well “Atypical” pneumonia: Mycoplasma, Chlamydia, MoraxellaSome mycobacteria/TB | UTI/GU infectionIntraabdomi-nal infectionsEndometritisHospital-associated lung infections Levo best for acute sinusitis/CAPNorflox: UTI only | IV/PO (Norflox PO)*IV=PO (bioequivalent)*Dizziness/CNSDiarrheaHypo-/hyperglycemiaSun sensitivityMay exacerbate myasthenia gravis & paralytic agents (inhibits GABA receptors)May prolong QTc (watch for palpitations/syncope)Rare spontaneous tendon rupture (watch for pain at tendon sites)C.difficile | YES, HIGH DOSE |
| **“Gram positive or Respiratory” Quinolone**moxifloxacin$$CIDAL | Pneumococcus, Streptococci, Staphylococcus (NOT MRSA)Legionella Gut anaerobesAtypical mycobac/TB | CAP/community-associated respiratory infectionsAcute sinusitisIntraabdom-inal infectionsSSTI | IV/PO *IV=PO (bioequivalent)*Above | UNKNOWN |
| **“Gram positive or SSTI” Quinolone**delafloxacin$$CIDAL | Streptococci, Staphylococcus (NOT MRSA)LegionellaGut anaerobesAtypical mycobac/TB | SSTI  | IV/PO *IV=PO (bioequivalent)*Above | UNKNOWN |

**Nitroimidazole**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/MISC** | **CSF** |
| metronidazole$$CIDAL | Gram – anaerobes incl. Bacteroides fragilis and all ClostridiaEntamoeba coli | *“Infections below the diaphragm”*Intraabdominal abscess, peritonitis, diverticulitis, etcEndometritis/Bacterial vaginosisClostridium difficile colitisAmebic liver abscess/dysenteryNOT to be given alone for lung abscess/ENT infections  | IV/PODisulfiram-like reaction (vomiting) if ethanol consumed within 3 days of therapyAseptic meningitis/neuropathies, rare | YES |

**Tetracyclines/Glycylcycline**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/MISC** | **CSF** |
| **Tetracyclines**MinocyclineDoxycycline$STATIC | **MRSA**/MSSA Pneumococcus, +/- GASE. coliLegionellaN. meningitidisHemophilusMoraxellaMycoplasmaChlamydia ListeriaBrucellaActinomycesRickettsiaVibrioAnaerobes: Fusobacterium, Cutibacterium, Peptostreptococcus, Clostridium, some Bacteroides fragilis/melanogenicus | SSTICAP, esp under age 40Dog/cat bite prophy as alternative to amox/clav | IV/PODiscoloration of permanent teeth in childrenPseudotumor cerebri, esp minocycline! (watch for headache)Sun sensitivityC.difficileInhibit lipopolysa-ccharide-induced proinflam-matory products | YES |
| **Glycylcycline**tigecycline \*\*$$eravacycline\*omadacyclinesarecycline (acne only)STATIC | Above, plus Staph. epidermidisEnterococciCorynebacteriumN. gonorrheaESBL + E.coli/KlebsStenotrophomonasAcinetobacterSalmonellaB. fragilis/anaerobesClostridia incl. C.difficileNOT Pseudomonas or Proteus\*eravacycline adds ESBL, carbap-R Acinetobacter | SSTIIntraabdom-inal infectionsCAP/HAPSevere C.difficileY alveolar, soft tissue, bile/gut entryPoor bone/joint, CNS\*\* Bacteriostatic - NOT for serious infections; **Increased mortality** vs. comparators in after-market review of pooled clinical trials, incl in FDA-approved indications. | IV onlyAbove20% tige, 6.5% erava - nausea, vomiting Inhibit lipopolysaccharide-induced proinflammatory products\*/\*\*Ampicillin/Amoxicillin CIDAL-preferred in VRE that is amp-susceptible. | UNKNOWN |

**Glycopeptides, lipoglycopeptides**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/****MISC** | **CSF** |
| vancomycin$CIDAL except *STATIC for Enterococci* | Gram + cocci except VRE/VRSA *Most* Gram + rods (but see below)CorynebacteriumListeriaC.diff (only PO)Increasing vancomycin MICs > 1 assoc with treatment failures (“MIC creep”)**Instrinsic resistance in:**LeuconostocLactobacillusPropionobacteriumPediococcusErysipelothrixClostridia(non-diff.) | SSTI due to MRSAHAP/CAP due to MRSAInfections due to VRE | Vanc IV$\ne $PO – PO not absorbed from gutVanc requires a **central IV line**, due to phlebitis (which may cause fevers, unnecessary antibiotics/cultures/increased lengths of stay…)“Red man syndrome” with vanc (histamine release) if infused too rapidly—infuse over 1-2 hoursLeukopeniaThrombocytopeniaRare interstitial necrosisOtotoxicity (abrupt, irreversible, usually elderly) | YES |
| dalbavancin$$$ | MSSA, MRSA, Group A, B streptococci, Strep anginosus group | SSTI1500mg IV x1 OR1000mg IV then 500mg in 7 days | Nausea, headache, diarrhea“Red man syndrome” with vanc (histamine release) if infused too rapidly—infuse over 1-2 hours |  |
| televancin $$$ | MSSA, MRSA/VISA/VRSA, Group A, B streptococci, Strep anginosus group, VSEnterococcus | SSTI HAPneumonia due to MRSA/VISA | N/V, foamy urine QTc prolongationMortality > with mod/sev renal impairment compared with vancoPossibly teratogenic—avoid in pregnancy unless maternal benefit exceeds fetal risk “Red man syndrome” with vanc (histamine release) if infused too rapidly—infuse over 1-2 hours Interferes with coag tests but not coagulation |  |
| oritavancin$$$CIDAL including *Enterococci* | MSSA, MRSA, Group A, B, C streptococcus, Streptococcus anginosus group, VSEnterococcus | SSTI1200mg IV x1, over 3 hr | Headache, N/V“Red man syndrome” with vanc (histamine release) if infused too rapidly—infuse over 1-2 hoursArtificially prolong PT/INR for up to 12 hr (5.1); aPTT for up to 120 hours, and may prolong PT and INR for up to 12 hr and ACT for up to 24 hr—Use Factor Xa assay for coagulation testingCoadministration with warfarin may result in higher exposure of warfarin and increase risk for bleeding; monitor frequently for signs of bleeding |  |

**Cyclic Lipopeptides**

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| **DRUG** | **COVER-AGE** | **USES** | **TOXICITY/****MISC** | **CSF** |
| daptomycin$$$$CIDAL  | All Gram + cocci incl. Vanc-/Amp-resistant\* Entero-coccusMRSA/VRSA  | SSTIBacteremiaOsteomyelitis, Joint infectionsMay be active in biofilms (which usually inactivate antibiotics) | IV onlyNausea/vomitingRhabdomyolysis & associated renal insufficiency (weekly creatinine, CPK)Rare asthmatic pulmonary eosinophiliaNOT for primary pneumonia because it is inactivated in alveolar fluid, BUT seems effective in embolic lung infection/septic emboli due to Gram +s, since the infection is more parenchymal.\*Ampicillin/Amoxicillin (CIDAL) preferred in VRE that is amp-susceptible.  | UNKNOWN |

**Streptogramins**

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| --- | --- | --- | --- | --- |
| **DRUG** | **COVER-AGE** | **USES** | **TOXICITY/****MISC** | **CSF** |
| quinupristin-dalfopristin$$$$CIDAL | Vanc-/Amp-resistant\* Enteroco-ccus faecium MSSAGroup A StrepNOT Enteroco-ccus faecalis or MRSA  | SSTI/non-MRSABacteremiaEndocarditis due to VRE faeciumExtremely limited use.  | IV onlyNeeds **central IV line due to frequent pain, phlebitis, fever**>30+% **Myalgias/****Arthralgia**sNausea/Vomiting/Diarrhea \*Ampicillin/Amoxicillin (CIDAL) preferred in VRE that is amp-susceptible.  | UNKNOWN |

**Oxazolidinone**

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| **DRUG** | **COVER-AGE** | **USES** | **TOXICITY/****MISC** | **CSF** |
| linezolid$$$$STATIC except CIDAL for streptococci | All Gram + cocci incl. \*\*Vanc-/Amp-resistant\* EnterococcusMRSA/VRSATB/Atypical mycobacteriaBinds 23S rRNA-blocks formation of 50s/70s ribosomal initiation complex  | SSTIMRSA HAP/CAP due to MRSAOsteomyelitis/Joint infections (very Y bone penetration)\*\*NOT for bacteremia without a well-defined and removal or draining focus, NOT for endovascular infections  | *IV=PO (bioequivalent)*Nausea/vomiting/diarrheaHeadacheThrombocytopenia/Neutropenia after 7 daysPeripheral/Optic neuropathies with extended useLactic acidosis (nausea, fatigue)**Serotonin syndrome:**Avoid high tyramine food/drink (> 100mg tyramine per meal). E.g. aged cheeses, dried/processed meats, ethanol, sauerkraut, soy sauce, or yeast extract/supplements, ferments\*/\*\*Ampicillin/Amoxicillin (CIDAL) preferred in VRE that is amp-susceptible.\*\*Associated **with treatment failure in bacteremia**, incl line & endovascular infections.  | GOODMyrianthefs et al. Serum and CSF concentrations of linezolidin neurosurgery patients. AAC 2016. 50(12): 3971-6. |
| tedizolid$$$$STATIC | All Gram + cocci incl. \*\*VRE, Amp-resistant\* Enterococcus, MRSA/VRSABinds 50s ribosomal subunit  | SSTI | *IV=PO (bioequivalent)*6 days tedizolid Qdaily = 10 days linezolid BID = higher lipid solubility/higher tissue levelsNausea/headache/diarrhea Lower thrombocytopenia than linezolid; similar neuropathic events; no longer term data**Serotonin syndrome:**Avoid high tyramine food/drink (> 100mg tyramine per meal). E.g. aged cheeses, dried/processed meats, ethanol, sauerkraut, soy sauce, or yeast extract/supplements, ferments | NO DATA – suspect similar to linezolid |

**Colistin/Polymixin B (Reserved for multi-drug resistant organisms - MDRO)**

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| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/MISC** | **CSF** |
| colistinpolymixin Bcolistimethate$$$CIDAL | Gram - including Pseudomonas, Acinetobactermembrane disruption, binds lipopolysacch-aride (LPS)/Gram - endotoxin | Intraabdominal infectionsUTI/GU infectionsPneumonia/Hospital-associated respiratory infectionsPotent anti-LPS binding/neutralizing activity | IV/Aerosol30% Nephrotoxi-city!Peripheral/Optic neuropathiesNeuromusc-ular blockade (may exacerbate myasthenia gravis & paralytic agents) | YES |

**Rifamycins**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRUG** | **COVERAGE** | **USES** | **TOXICITY/MISC** | **CSF** |
| rifampin$-$$Only rifampin is discussed here, in context of use outside of mycobac-terial infections CIDAL | Very broad, incl Gram +/ Gram - , mycobacteria; use is *condition*-specificRAPID RESISTANCE if given alone – *Use in combinations*Inhibits DNA-dependent RNA polymerase | *Only* used alone as prophylaxis against Neisseria meningitidis (2 days), Hemophilus influenza b (4 days) in contacts/nasal carriageCombination treatment in serious S. aureus, Streptococcal infectionsCombination treatment of Legionella, Anthrax, Brucella, Bartonella, Anaplasma, EhrlichiaCombination treatment of tuberculous and non-tuberculous Mycobacteria | IV/PORed urine, sweat, tears, saliva – hold soft contact useNausea, abd painHepatotoxi-city (avoid ethanol & hepatotoxins), hyper-bilirubinemia Type I & Flu-like hypersensi-tivityAutoimmune reactionsMany drug interactions – always check an updated reference | YES |

**References:**

<http://webedition.sanfordguide.com/>

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Thank YOU, dear Colleague, for your dedication to the Art and Science of Medicine. I hope that you find this tool of help in your care of the VIP at the center of our efforts:

The Patient.

Dr. G