Pearls of antibiotics Use

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1ST GENERATION CEPHALOSPORIN

Cephalexin- Oral
Cefadroxil – Oral
Cefazolin – Injectable
Cephradine - Oral and Injectable

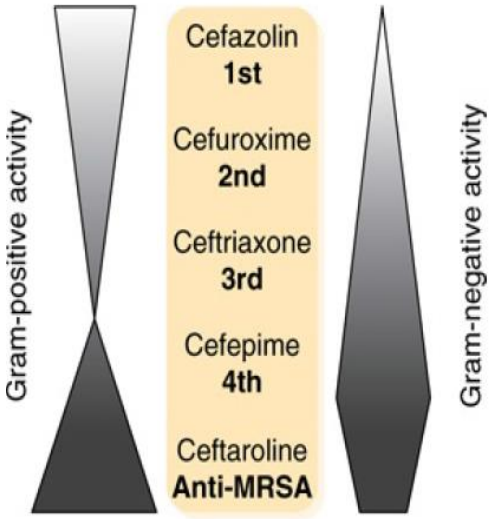


Figure 7–2 Cephalosporin Activity

Key points:

1. Excellent GP coverage and some gram negative
2. Do not cross blood brain barrier
3. Useful for surgical prophylaxis and mild skin and soft tissue infections often used alternative to Oxacillin or nafcillin

Rx recommendations of 1st Gen Ceph

Injectable **Cefazolin** is routinely used in Surgical prophylaxis where low prevalence of MRSA.

Oral cephalosporins –Cephalexin, Cefadroxil, Cephradine are commonly used for less severe soft tissue infections, including impetigo, early cellulitis and mild diabetic foot ulcer

When treating MSSA infections orally,e.g. Cephalexin is preferable. Oral 3rd gen Cephalosporin do not have much Anti ***S.aureus*** (MSSA) activity like Cephalexin

Please remember: Cephalexin is suboptimal for RTI, (Otitis media, sinusitis, CA pneumonia) where *H.influenzae* is likely pathogen (since 1st gen Ceph has limited *H.influenzae* activity)

DOSING FOR SURGICAL PROPHYLAXIS

For Surgical prophylaxis: One dose 2g (3g for >120 kg) of cefazolin (IV) within 1 hour of skin incision and continue 24 hours postoperatively. Repeat dose 4 hours after 1st dose if still in surgery or estimated blood loss over 1,500 mL

Giving more than 24 hours of antibiotics is rarely justified. Such use does not lower infection rates, but it can select for more resistant organisms later in the hospital stay.

2ND GENERATION CEPHALOSPORIN

- Cefaclor – oral , Cefotaxime- Injectable
- Cefprozil- oral , Cefuroxime – Oral + Injectable

Key points:

1. Improve GN coverage including *H.influenzae, N.gonorrhoeae* and Moraxella
2. Cefuroxime is popular oral preparation, less costly

Rx RECOMMENDATIONS

Cefaclor, Cefprozil, cefuroxime are used primarily to treat URTI.

Cefaclor has limited capacity to penetrate respiratory secretions limiting its efficacy in treatment of URTI. Is recommended for *S.saprophyticus*

Cefprozil has greatest degree of penetration into respiratory secretions maximizing its efficacy in treatment of URTI

3RD GENERATION CEPHALOSPORIN

- Cefdinir –oral ,Cefditoren – oral
- Cefixime – oral , Ceftibutan- oral
- Cefoperazone – Injectable , Ceftazidime- Injectable , Ceftriaxone- Injectable

Key points

1. Improved GN coverage
2. Excellent activity against *H.influenzae, N.gonorrhoeae, N.meningitidis,* and Moraxella
3. Ceftriaxone has long half life with once daily dose
4. Ceftazidime has Excellent activity against *Ps.aeruginosa but reduced S.aureus*
5. Increasing frequency of ESBL endangering their effectiveness

Spectrum: Streptococci (except ceftazidime, which is poor), enteric GNRs, *Pseudomonas* (ceftazidime only) MSSA (except ceftazidime, which is poor)

Rx Recommendation for 3rd Gen Ceph

Ceftazidime- though it has antipseudomonal activity but 4th gen Ceph **"Cefepime"** and **Aztreonam** are used for Rx of **Pseudomonas** infections. Because it is inducer of resistance

Ceftriaxone and Cefotaxime are recommended for **CA pneumonia** and **CA bacterial meningitis**
Oral Cefixime and others are potential second line therapy for **CA pneumonia** with once daily dose and is alternative to penicillin for Rx of bacterial pharyngitis.

3rd generation cephalosporins can be combined with other antibiotics for Empirical treatment of sepsis.

Important points to remember
Ceftriaxone, Cefotaxime, Ceftizoxime does not have significant anti *Ps aeruginosa activity*
Ceftazidim has anti *Ps aeruginosa activity* and it also predisposes to *MDR Ps aeruginosa, ESBL Kl. pneumoniae, E.coli or Enterobacter* and increases *MRSA prevalence has little MSSA activity.*

4TH GENERATION CEPHALOSPORIN

Cefepime -Ceftipime, Maxpime, Ultrapime

Key points

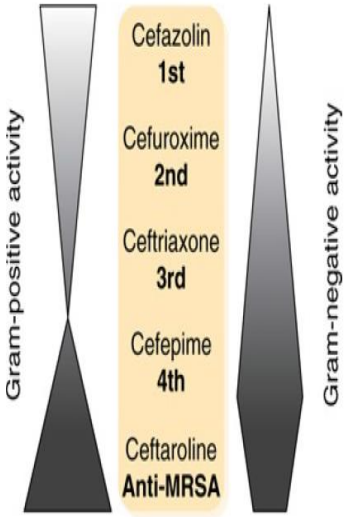
1. Excellent Broad spectrum empiric therapy useful in nosocomial infections.
2. Excellent penetration to bacterial cell wall, human tissues and fluid including blood brain .
3. More resistant to ESBL and chromosomal beta lactamases
4. Excellent activity against GPC including MRSA and GNB including *Ps aeruginosa*
5. Weak inducer of beta lactamases and effective against MRSA

Rx recommendation

1. Excellent empiric therapy useful in nosocomial infections.
2. Effective against gram negative meningitis
3. Effective against as single agent in febrile Neutropenic patients
4. Active against Ceftazidim resistant Ps. aeruginosa strains.

Note: for Ps. aeruginosa and MDR GNB use high dose cefepime i.e. 2 gm IV q8hr

ANTISTAPHYLOCOCCAL CEPHALOSPORIN



- Ceftaroline , Cefiderocol - Not available in BD

Key points

1. Has increased affinity for PBPs particularly PBP2a found in MRSA and VISA
2. Also higher affinity for PBPs 1-3 of MSSA and *S.pneumoniae* PBP2x/2a/2b
3. Similar gram negative coverage like ceftriaxone

Rx Recommendation

1. ***Community acquired pneumonia***
2. ***complicated soft tissue infections*** **particularly when MRSA is suspected**

AMINOPENICILLINS

- Ampicillin- Ampexin, Acmecillin, Amoxicillin –Aristomax, Avlomox,

Spectrum:
Streptococci, VSE, PRSP (Amoxycillin high doses), Some GNRs, *Haemophilus (beta lactamase-ve)*

Don't confuse: Susceptibilities of Ampicillin and Amoxycillin are not same because of concentration on a same dose of Amoxycillin achieves twice the concentrations in the body fluids than Ampicillin e.g. middle ear fluid, sinus fluid, bronchial fluid & urine)

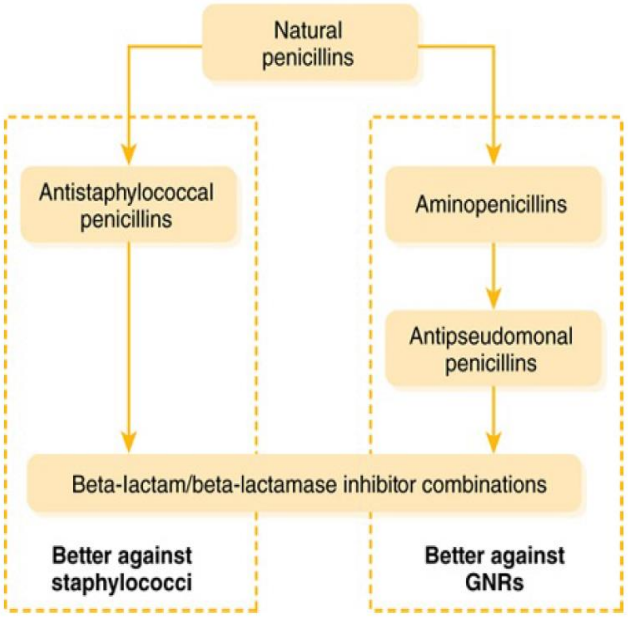


Figure 7–1 Penicillin Drug Development

Rx recommendations for Ampi/ Amoxy

1. Parenteral Ampicillin is indicated for *Listeria monocytogenes* and non beta lactamase producing *H.influenzae*

2. Ampicillin plus aminoglycoside is the treatment of choice for enterococci.

3. Amoxicillin is frequently prescribed for URTI including streptococcal pharyngitis and otitis media.

4. Amoxicillin is alternative regimens for **UTIs in pregnant women** (pregnancy category B) and eliminated renally.

Susceptibility testing should be performed because resistance in *Escherichia coli* is very high.
Always perform follow-up cultures in pregnant women with UTIs since even asymptomatic bacteriuria is dangerous for them.

AMOXYCILLIN/CLAVULANIC ACID

Spectrum: Streptococci, enterococci, MSSA, Enteric GNRs, *Haemophilus, B.fragilis*

Clavulanic acid is a beta-lactamase inhibitor which restores activity of Amoxycillin against beta-lactamase producing strains of *H.influenzae*. But ineffective against penicillin resistant *Strep. Pneumoniae* because that resistance is not beta-lactamase mediated rather due to PBP alteration

Rx recommendations

1. URTI including streptococcal pharyngitis and otitis media.
2. **UTIs in pregnant women**
3. **Skin and soft tissue infections due to Streptococcus and MSSA**

Please remember: Use of **Amoxycillin/clavulanic acid combined with antistaphylococcal penicillins is useless and will give any added benefit.**

ORAL ANTISTAPHYLOCOCCAL PENICILLINS

- Cloxacillin, Dicloxacillin , Flucloxacillin

Key points:

1. Very narrow spectrum, Only GPC (MSSA
2. Short half-life, hepatically metabolized

Rx recommendations:

Primary indication is for MSSA and cellulitis but Don't rely on oral antistaphylococcal penicillins for treating MSSA, since they are poorly or erratically absorbed and not consistently effective.

When treating MSSA infections orally, **a first generation cephalosporin e.g. cephalexin is preferable.**

Please remenber : Use of **Amoxycillin/clavulanic acid combined with antistaphylococcal penicillins is useless and will not give any added benefit.**

MONOBACTAMS

Aztreonam – Injectable AZONAM

Key points

1. No cross reactivity with penicillin / beta lactams, can be safely used in penicillin allergic patients.
2. Binds PBP-3 of GNB but not of GPB
3. Narrow spectrum, excellent against GNR, no activity against GPB
4. Excellent empiric antibiotic when combined with antibiotics with good GPB activity
5. Penetrates body tissues well and cross BBB of inflamed meninges.

Rx Recommendations of Monobactam

1. Effective against most GNB and marketed as non nephrotoxic replacement for aminoglycosides.
2. Can be used for effectively For
   - Pyelonephritis,
   - Nosocomial GNB pneumonia,
   - GN bacteremia,
   - GN intrabdominal infections

Note1: Aztreonam has no gram positive or anaerobic activity, when used for empiric treatment of seriously ill patients, should be combined with vancomycin, clindamycin, erythromycin or a penicillin

Note 2: Aztreonam has no synergy with penicillin in enterococcal infections. Not helpful in *Streptococcus viridans* endocarditis

CARBAPENEMS

- Imipenem +Cilastatin, Meropenem, Doripenem, Ertapenem

Key points:

1. Beta lactam ring is highly resistant to cleavage
2. Can penetrate all tissues
3. Very broad spectrum, against aerobic, anaerobic, GNB, GPB, also covers listeria & Nocardia
4. But MRSA, PRSP, *C.difficile, St. maltophilia, B.cepacia are resistant.*
5. Bind PBP of all bacteria with high affinity
6. Frequent cross reactivity with penicillin allergic patients (7%).
7. Imipenem causes seizures at high doses, Meropenem less epileptogenic.
8. Ertapenem lacks pseudomonas aeruginosa activity but can be given once daily dose.
9. Treatment alters normal flora

Rx Recommendations of Carbapenem

1. Sepsis: Imipenem +Cilastatin, Meropenem and Doripenem as empiric therapy for sepsis and particularly useful if polymicrobial etiology is a strong possibility
2. Intra-abdominal infections and complicated pyelonephritis

3. Meningitis : Meropenem and Doripenem but not Imipenem because of risk of seizure.

4. Ertapenem : Complicated Intra-abdominal infections, post partum and postoperative acute pelvic infections, complicated soft tissue infections.

Note: Meropenem penetrates the inflamed prostate (acute prostatitis) but not the chronically inflamed prostate (chronic prostatitis)

BETA- LACTAMS INHIBITOR COMBINATIONS

- ampicillin/sulbactam,
- amoxicillin/clavulanate, piperacillin/tazobactam,
- Ceftazidim/avibactam, ceftolozone/tazobactam
- Meropenem/Vaborbactam, Impenem/Relebactam

Spectrum

MSSA, streptococci, enterococci, many anaerobes, enteric GNRs, *P. aeruginosa* (only piperacillin/tazobactam) GNRs with advanced beta-lactamases

Rx recommendations:

- Some strains of MDR Acinetobacter are susceptible only to ampicillin/sulbactam
- Ceftolozone/Tazobactam is effective against MDR GNB but not CRE
- Meropenem/Vaborbactam, Impenem/Relebactam are is effective against CRE

Ceftazidim/avibactam, ceftolozone/tazobactam though have some anti *B.fragilis* activity, but for Community Acquired intrabdominal infections, should be used along with metronidazole.

TETRACYCLINES

- Doxycycline, Minocycline, Earavacycline, Omadacycline

Spectrum : Atypicals, rickettsia, spirochetes *H. pylori*, B. fragilis (Doxy, Mino) Staphylococci (including MRSA), *Streptococcus pneumoniae*

Rx recommendations:

- Doxycycline is One of few oral drugs effective against urinary CRE pathogens. And effective against for nearly all non-viral zoonotic infections.
- Doxycycline though susceptible against MRSA in vitro frequently results in clinical failure.
- Minocycline IV/PO is more effective against MRSA than Doxycycline and is useful to treat serious systemic infections due to MSSA/MRSA i.e. (ABE, osteomyelitis, meningitis)

CLINDAMYCIN

- Key points:

1. Diarrhea due to *C.difficile* is common side effect (in 20% patients)
2. Active against most GPB including MSSA but not VSE or VRE. Has excellent anaerobic coverage including *B.fragilis*
3. Used to reduce toxin production by *S.pyogenes* and *S.aureus*
4. Metabolized primarily in liver and excreted through bile

Rx recommendations:

- Clindamycin is one of the few antibiotics able to penetrate/ dissolve staphylococcal biofilms, useful as adjunctive therapy when the prosthetic valves can not be removed.
- In combination with a first generation cephalosporin can be used to block toxin production in severe cellulitis and necrotizing fascitis.

Note: With CA-MRSA, inducible clindamycin resistance should be suspected if erythromycin is resistant and clindamycin is susceptible. A positive "D" test confirms clindamycin resistance.

AMINOGLYCOSIDES

- Gentamicin, Amikacin

Aminoglycosides have a narrow therapeutic to toxic side effects ratio and monitoring of serum level is generally required to prevent toxicity.
Should be avoided when alter drug is available

Key points:

1. Soluble in water, positively charged never use with cephalosporins or acidic solution
2. Killing is concentration dependent, PAE increases in proportion to concentration.
3. Excellent gram negative coverage
4. Synergy with penicillins in *S.viridans*, Enterococcus, and *Ps. aeruginosa*
5. Cause temporary holes in cell membrane and interferes with protein synthesis.

Rx recommendation of Aminoglycosides

An aminoglycoside is used in combination with other antibiotics is recommended for treatment of severely ill patients with sepsis syndrome.

Combined with penicillin is recommended for empiric coverage of bacterial endocarditis.
Gentamicin Combined with penicillin is treatment of choice for both *S.viridans* and *E.* faecalis

Avoid monotherapy in nosocomial pneumonia since their activity is diminished in presence of tissue hypoxia, WBC debris and local acidosis

KEY POINTS ABOUT TOXICITY OF AMINOGLYCOSIDES

- Nephrotoxicity is usually reversible and incidence is higher in
  - Elderly individuals, patients with preexisting renal disorders,
  - patients with volume depletion and hypotension, patients with liver disease
- Higher incidence of with co-administration of vancomycin, cephalosporin, clindamycin, piperacillin or furosemide
- The loss of high frequency hearing and vestibular dysfunction is often devastating for elderly

Ototoxicity may occur with extremely high peak / prolonged peak levels not episodic peak levels.
Nephrotoxicity should not be assessed by serum creatinine levels. Best assessed using urinary renal cast counts which indicates renal damage.

Note: Limiting therapy to two weeks once daily dosing minimizes the risk of Nephrotoxicity.

KEY POINTS ABOUT DOSING AND SERUM MONITORING OF AMINOGLYCOSIDES

1. Aminoglycosides take 15-30 min to equilibrate in the body.
2. For a multi-dose therapy, blood for peak serum level should be drawn 30 min after infusion
3. Blood for trough level should be drawn just before next dose.
4. Once daily dosing has advantages of concentration dependent killing and PAE
5. Once daily dosing reduces but does not eliminate nephrotoxicity
6. In most cases, trough levels need to be monitored only during once daily dose. Toxicity correlates with high trough levels
7. Once daily dosing is not recommended for enterococcal endocarditis or pregnant women.

QUINOLONES

Ciprofloxacin, Ofloxacin, levofloxacin, Moxifloxacin

Key points:

1. Ciprofloxacin- Excellent for *Pseudomonas* and also cover other GN including *E.coli, Salmonella, Shigella, Neisseria* plus Atypicals
2. Ofloxacin, levofloxacin, Moxifloxacin- greater activity against *S.pneumoniae* including PRSP, also covers MSSA. Only Delafloxacin has anti MRSA activity
3. Cipro, levo are eliminated by kidney, Moxi partially by liver.
4. All demonstrate similar tissue penetration being concentrated in prostate, faeces, bile and lung tissue
5. Arthropathy and tendonitis . May damage cartilages.

Rx recommendations:

1. Ciprofloxacin is Recommended for UTI, Prostatitis, gonococcal urethritis, Travellers diarrhea, Typhoid fever & Salmonella gastroenteritis.
2. Ofloxacin, levofloxacin, Moxifloxacin are recommended for CA pneumonia (Levofloxacin preferred)
3. levofloxacin, Moxifloxacin also recommended for mixed skin infections. For meningococcal prophylaxis quinolones

NITROFURANTOIN -Urinary antibiotic

Spectrum:

E. coli, Citrobacter, Klebsiella, Proteus, S. saprophyticus, Enterococci,

Rx Recommendation:

Nitrofurantoin is ideal oral agent for treatment of acute uncomplicated cystitis (AUC) or community acquired bacteremia (CAB)

BUT If CrCL <30ml/min, It may not be effective

Please note:

Nitrofurantoin is effective against ESBL +MDR GNB uropathogens including CRE strains (NDM-1), except *Ps aeruginosa, Serratia marcescens or proteus sp.*

FOSFOMYCIN

Spectrum:
E. coli, Staph saprophyticus Citrobacter, Klebsiella, Proteus, Enterococci, Pseudomonas, Serratia

Fosfomycin is highly active against most MDR uropathogens as well as VSE/VRE, one of the few oral Abx can be used against most MDR uropathogens including CRE.
High urinary concentrations minimizes potential GNB resistance

Rx Recommendation:
Oral: Acute and chronic prostatitis due to MDR GNB because it penetrates well into inflamed and non-inflamed prostate in therapeutic concentrations. Duration in chronic prostatitis (due to MDR GNB) may need to be prolonged (weeks).
IV Fosfomycin in systemic infections due to GNB including MDR and CRE strains. And is one the few antibiotics useful in in IV to PO switch program in the treatment of MDR GNB and CRE.

VANCOMYCIN

Spectrum:
MRSA, MSSA (less effective), Streptococci, *Clostridium difficile,* Enterococci, CONS

Rx Recommendation:
Treatment of choice for MRSA and CoNS.
Excellent activity against Penicillin Resistant *S pneumoniae*.
Also recommended for *S.pyogenes, Gr B Strep, S.viridans and S. bovis* in penicillin allergic patients.
Oral vancomycin is preferred over oral metronidazole for *C.difficile* diarrhea, but metronidazole is preferred for ***C.difficile colitis.***

Other antistaphylococcal drugs (1st gen cephalosporin, Flucloxacillin) are preferable to treat cSSI and bacteremia /ABE due to MSSA.

Vancomycin penetrates well into bone but not in synovial fluid

Points to remember & Key points on Toxicity

May cause bacterial cell wall thickening resistance manifested by increased MICs to vancomycin and other antibiotics.
IV predisposes to VRE but not oral dose.

Please note:
No need for vancomycin levels for usual vancomycin dosing. However vancomycin levels may be useful in patients with usually high volume of distribution (Vd) e.g. edema/ascitis, trauma, burns)

Key points on Toxicity:

1. Rapid infusion is associated with "red man syndrome"
2. Phlebitis is common
3. Rarely nephrotoxic, potentiates aminoglycosides toxicity
4. Ototoxicity leading to deafness uncommon

Oxazolidinones Linezolid

Key points

1. Demonstrates activity only against GPB
2. Active against MRSA, MSSA, PRSP, VRE
3. Thrombocytopenia common with Rx for > 2 weeks.
4. Linezolid does not increase VRE prevalence.

Rx Recommendation:

Recommended for treatment of VRE

Linezolid is one of the few oral antibiotics that can be used in CNS infections due to Gram positive Acute Bacterial Meningitis pathogens (MSSA, MRSA, CoNS, listeria)

MACROLIDES

- Erythromycin, Azithromycin, Clarithromycin

Key points:

- *Spectrum* : Atypicals, *H. influenzae*, *M.catarrhalis*, *H. pylori*, *M. avium S. pneumoniae*, *S. pyogenes*, *mouth anaerobes*
- can cause irritative diarrhea but not C.difficile diarrhea
- QT prolongation occurs with erythromycin but not with Azithromycin (due to low serum levels)

Rx Recommendation:

1. For - Community acquired pneumonia, Bacterial sinusitis and otitis media
2. Clarithromycin or azithromycin for *H. pylori*
3. Telithromycin is effective against PRSP.
4. Clarithromycin is a primary drug against *M.avium-intracellualre*

Macrolides have been responsible for PRSP and MDRSP, use Doxycycline or a " respiratory quinolone"

METRONIDAZOLE -METRONIDAZOLE, TINIDAZOLE

Key points:

1. Excellent activity against anaerobes, *H. Pylori* Amoeba, *Giardia* and *Trichomonas*
2. Penetrates tissues well, including abscesses
3. To be avoided in pregnancy
4. Has no action against aerobic bacteria
5. Long serum half life
6. Hepatic elimination

Rx Recommendation:

1. Trichomoniasis, amebiasis and giardiasis
2. IV is preferred therapy for ***C.difficile* colitis.**
3. in combination with cephalosporin for mixed bacterial infections
4. *H.pylori* gastric and duodenal infection (as combined regimen)

Oral Metronidazole therapy frequently fails and is inferior to PO vancomycin for *C.difficile* diarrhea and leads to increased VRE prevalence

Don't combine Metronidazole and Moxifloxacin for intra-abdominal infections (no rationale for double anti *B. fragilis* coverage)

COLISTIN- COLISTIN METHANESULHONATE

Key points:

1. Colistin have no activity against *Proteus, Providencia, Morganella, Serratia or B.cepacia*
2. Concentration dependent, renal clearance with long half life . No adjustment required for hepatic insufficiency
3. Nephrotoxicity in 1-10% patients. >risk in elderly, renal insufficiency, low serum albumin, administered with vancomycin or NSAIDS. Usually reversible.
4. Being a large molecule has limited extravascular distribution, does not cross BBB or enter joint fluid
5. Poor penetration into pleural fluid and biliary tree.

Rx Recommendation:

1. last resort for the treatment of multidrug resistant GNB
2. Should be reserved for highly resistant nosocomial pathogens such as *Ps.aeruginosa, Acinetobacter baumannii, St.maltophilia, and klebsiella pneumoniae*
3. as aerosol for the treatment of Pneumonia particularly in cystic fibrosis.

TIGECYCLINE

Spectrum:

Atypicals, Enterococci (including VRE), Staphylococci (including MRSA), *S. pneumoniae,* most GNRs, Anaerobes

Rx Recommendation:

Tigecycline is highly active against **MDR *Klebsiella pneumoniae*** and may be only effective drug against such strains.

It is one of only a few antibiotics effective drug against CRE (including NDM-1 strains)

Tigecycline may be safely given to patients with penicillin or sulpha drug allergy but avoid in patients with tetracycline allergy.

Resistance potential of selected antibiotics

High resistance Abx to avoid	Organism	Preferred low resistance potential
Gentamicin or Tobramycin	*Ps. aeruginosa*	Amikacin, Levofloxacin, Colistin, cefepime
Ceftazidime	*Ps. aeruginosa*	Cefepime, Levofloxacin, Colistin
Tetracycline	*S.pneumoniae* *S.aureus*	Doxycycline, Minocycline, Levofloxacin, Moxifloxacin
Ciprofloxacin	*S.pneumoniae*	Levofloxacin, Moxifloxacin, Doxycycline,
Ciprofloxacin	*Ps. aeruginosa*	Levofloxacin, Amikacin, Colistin, cefepime
Vancomycin	MSSA, MRSA	Linezolid, Minocycline, Tigecycline
Imipenem	*Ps. aeruginosa*	Meropenem, Amikacin, cefepime Colistin
Azithromycin	*S.pneumoniae*	Doxycycline, Levofloxacin, Moxifloxacin

LIMITATIONS OF SUSCEPTIBILITY TESTING

1. In vitro data does not differentiate between colonizers and pathogens
2. In vitro data does not necessarily translates into in vivo efficacy
3. Antibiotic effectiveness depends body site conc., local pH, degree of inflammation, cellular debris, local oxygen levels, blood supply and penetrability.
4. In vitro susceptibility dependent on the microbe, methodology, pH and antibiotic concentrations.
5. In vitro susceptibility assumes the isolate was recovered from blood, using serum conc. as given in usual dose.
6. Some body sites e.g. bladder urine contains higher concentrations and other body sites e.g. CSF may be lower than the serum
7. Dose of antibiotics should not be given at lower doses, otherwise there will be treatment failure. E.g. cefoxitin 2 gm IV inhibits 85% *B. fragilis* whereas 1 gm dose inhibits only 20%

EXAMPLES WHERE IN VITRO SUSCEPTIBILITY DOES NOT PREDICT IN VIVO EFFECTIVENESS

Antibiotic	Organism
Penicillin	*H.influenzae, VSE*
TMP-SMX	*Klebsiella, VSE*
Colistin	*Proteus, Salmonella*
Imipenem	*St.maltophilia*
1st, 2nd gen Cephalosporin	*Salmonella, Shigella*
3rd,4th gen Cephalosporin	*MRSA, Listeria*
Quinolones	MRSA
Aminoglycosides	*Streptococci, Salmonella, Shigella*
Clindamycin	*Fusobacteria*

BACTERICIDAL VS. BACTERIOSTATIC

- For most infections, bacteriostatic and Bactericidal antibiotics inhibit or kill microbes at same rate and **should not be factor in antibiotic selection.**

- Bactericidal antibiotics have an advantages in certain infections such as **endocarditis, meningitis, febrile leukopenia.**

MONOTHERAPY VS. COMBINATION THERAPY

- **Monotherapy is preferred to combination therapy nearly for all infections**
- In addition to cost savings, Monotherapy results in less chance of medication error and fewer missed doses/ drug interactions.
- Combination therapy may be useful drug synergy or for extending spectrum beyond what can be obtained with a single drug
- Combination therapy is not effective in preventing antibiotic resistance except in few cases like Tuberculosis

IV TO PO SWITCH

- After hospital admission usually IV therapy started then switched to equivalent oral therapy after clinical improvement (usually within 72 hours)
- Advantages of early **IV to PO** switch program include
  - reduced cost,
  - early hospital discharge,
  - less need for home IV therapy, and
  - virtual elimination of IV line infections
- Drugs well suited for IV to PO switch have high bioavailability e.g. Doxycycline, Minocycline, Metronidazole, Amoxycillin, Cotrim, Quinolones and Linezolid

Duration of therapy

- Most bacterial infections in normal hosts are treated for 1-2 weeks
- The duration of therapy may need to be extended in patients with impaired immunity
  - Diabetes
  - SLE
  - Alcoholic liver disease
  - Neutropenia
  - Endocarditis,
  - Osteomyelitis
  - Chronic viral and fungal infections
  - Certain intracellular bacteria


BE
ANTIBIOTICS
AWARE
SMART USE, BEST CARE