

Antibiotics



Objectives

- Define antibiotic ,chemotherapy and selective toxicity
- Describe the difference between bactericidal and bacteriostatic antibiotics
- Recognize the narrow and broad spectrum antibiotics
- Define the therapeutic index
- Know the mechanism of action of antimicrobial agents.
- Recognize the various classes of antimicrobial agents(action, spectrum and side effects)
- Explain the criteria for an ideal antimicrobial

Classes of Antibiotics~Mechanism of Action and Spectrums of Activity

Color guide Gram + / Gram - / anaerobes / from Dr.Ali

Antibiotics class	Examples	Mechanisms	Spectrum of Activity	S/E
INHIBITION OF CELL WALL				
(β-Lactam) Penicillins	Natural; penicillin G Semi-synthetic: oxacillin, ampicillin- clavulanic acid, ampicillin- sulbactam	Inhibit peptoglycan synthesis necessary for cell- wall formation	Bactericidal-most active against gram +; synthetic and potentiated penicillin have improved gram – coverage	Hypersensitive, anaphylaxis GIT
(β-Lactam) CEPHALOSPORINS	<u>1ST generation:</u> cephalothin, cephalexin, <u>2nd generation:</u> Cefuroxime <u>3rd generation:</u> ceftriaxone, ceftazidime <u>4th generation:</u> Cefepime		Bactericidal <u>1st gen:</u> Gram +, limited Gram ~ <u>2nd gen:</u> Gram+, improved Gram – and some anaerobes. <u>3rd gen:</u> limited Gram+, excellent Gram- and anaerobes	

Glycopeptides	Vancomycin		Bacteriocidal; Gram+ve bacteria <u>only</u> MRSA	* Red man syndrome *Neprototoxicity
Inhibition of protein synthesis (bind to ribosomes)				
Aminoglycosides "Cannot be used for anaerobes"	Gentamicin, amikacin, tobramycin, neomycin	Bind 30S ribosomal subunit; inhibit peptide elongation	Bacteriocidal; Gram-, including <i>Pseudomonas</i> and <i>Mycobacterium</i> , <i>Streptococcus</i> and anaerobes are resistant	Ototoxicity Nephrotoxicity " More important than Vancomycin"
Tetracyclines "Cannot be used for pregnant and children under 8 year"	Tetracyclines, doxycycline	Bind 30S subunit; inhibit RNA function	Bacteriostatic; Gram+ and Gram -; <i>Rickettsiae</i> , <i>Mycoplasma</i> , <i>Chlamyphila</i>	Teeth discoloration GIT photosensitivity
Chloramphenicol	Chloramphenicol	Bind 50S subunit, inhibit protein synthesis	bacteriocidal; broad Gram+ and Gram- spectrum * used for meningitis	BM aplastic anemia
Macrolides And lincosamides	Erythromycin Azithromycin Clarithromycin Clindamycin	Bind 50S subunit; inhibit protein synthesis	Bacteriostatic; Gram+, <i>Legionella</i> , <i>Camphylobacter</i> , <i>Mycoplasma</i> , <i>Chlamyphila</i> , <i>Rickettsiae</i> , *Clindamycin has good anaerobic spectrum	GIT pseudo- membranous colitis

Antibiotics class	Examples	Mechanism	Spectrum of Activity	S/E
INHIBITION OF NUCLEIC ACID SYNTHESIS				
1. QUINOLONES "Cannot be used for children under 18 year"	1 st generation: Nalidexic acid 2 nd generation: Fluoroquinolones Ciprofloxacin ~ 3 rd generation: Gatifloxacin 4 th generation: Moxifloxacin	Inhibits DNA gyrase , preventing supercoiling →DNA degradation	Bactericidal; Gram +ve and gram -ve, INCLUDING Pseudomonas at a higher dosage	Cartilage damage
2. Nitroimidazoles	Metronidazole * <u>the only can cover Bactria and parasite</u>	Metabolized by anaerobes to intermediates that prevent DNA synthesis	Bactericidal; anaerobes (Also antiprotozoal)	GIT
3. Rifampicin (used for TB)	Rifampicin	DNA degradation	Bactericidal; Gram +ve and gram -ve bacteria	Discoloration of body fluid hepatotoxicity
INHIBITION OF BACTERIAL GROWTH				
Sulfonamides	Trimethoprim-sulfadiazine, ormethoprim sulfa	Competitive analogue of para-aminobenzoic acid (PABA) →inhibits dihydrofolate reductase→ blocks folic acid synthesis	Bacteriostatic → bactericidal when combined. Gram -ve Chlamydia, nocardia, protozoa and pneumocystic	Discoloration of body fluid hepatotoxicity

Antibiotics class	ACTION	USE	S/E
Anti-Tuberculosis Agents			
1. Anti TB isoniazide (INH)	Bacteriocidal All lung tissue	T.B treatment and prophylaxis	Hepatotoxicity peripheral neuropathy
2. Ethambutol	bacteriocidal concentrated lung alveoli phagolysosome	TB treatment	Optic neuritis , Hepatotoxicity
3. Pyrazinamide	Acid environment of macrophages	TB treatment	Hepatitis gouty arthritis, Hepatotoxicity
ALTERATION OF CELL MEMBRANE			
Polymyxin "Cannot be used for pregnant"	Colistin	Alter cell membrane permeability For <u>multi-resistant organisms</u> (MRO)	Bacteriocidal; Gram-ve bacteria