

# Antibiotics

I.

# Consequences of inappropriate antibiotic therapy

- Inappropriate antibiotic therapy can lead to increases in:
  - mortality
  - morbidity
  - resistance selection

# Inappropriate antibiotic therapy can be defined as:

- ineffective empiric treatment of bacterial infection
- the wrong choice, dose or duration of therapy
- use of an antibiotics to which the bacterial pathogens are resistant

Clinical evidence suggests that use of appropriate antibiotic therapy improves patient outcomes in terms of:

- reduced mortality
- reduced morbidity

- Antibiotic mode of action:
  - cell wall synthesis inhibitors
  - protein synthesis inhibitors
  - nucleic acid synthesis inhibitors
  - cytoplasmic membrane function inhibitors
  - other agents that affect DNA

# Cell wall synthesis inhibitors

- Antibiotics that inhibit bacterial cell wall synthesis include:
  - $\beta$ -lactams: penicillins, cephalosporins, carbapenems, monobactams
  - glycopeptides: vancomycin, teicoplanin
  - bacitracin

# Protein synthesis inhibitors

- Antibiotics that inhibit bacterial protein synthesis include:
  - aminoglycosides: gentamicin, tobramycin, amikacin, netilmicin, streptomycin, isepamicin
  - tetracyclines
  - MLS group: macrolides (eg erythromycin), lincosamides, streptogramins (eg quinupristin–dalfopristin)
  - chloramphenicol
  - oxazolidinones

# Nucleic acid synthesis inhibitors

- Antibiotics that inhibit bacterial nucleic acid synthesis include:
  - precursor synthesis inhibitors: sulphonamides, trimethoprim
  - DNA replication inhibitors: quinolones
  - RNA polymerase inhibitors: rifampicin

# Cytoplasmic membrane function inhibitors

- Polymyxins

# Other agents that affect DNA

- Nitroimidazoles

# Resistance to antibacterial agents

- Antibiotic resistance is a result of innate consequences or is acquired from other sources
- Bacteria acquire resistance by:
  - mutation
  - addition of new DNA

# Mechanisms of antibacterial resistance (1)

- Modification of antibiotic target site, resulting in:
  - reduced antibiotic binding
  - formation of a new metabolic pathway

# Mechanisms of antibacterial resistance (2)

- Changed uptake of antibiotics, resulting in:
  - decreased permeability
  - increased efflux

# Mechanisms of antibacterial resistance (3)

- Inactivation of antibiotics
  - production of enzymes that inactivate antibiotics
    - $\beta$ -lactamases
    - aminoglycoside-modifying enzymes