Introduction to Antibiotics

Prof. Mohammad Alhumayyd
Pharmacology Department

Definition of Antibiotics

Chemical substances produced by various microorganisms (bacteria, fungi, actinomycetes) that have the capacity to inhibit or destroy other microorganisms.

Now a day they are chemically synthesized.

They either kill bacteria(bactericidal) or keep more bacteria from growing(bacteriostatic).

Antibiotics will not cure infections caused by viruses.

CLASSIFICATION OF ANTIBIOTICS ACCORDING TO MECHANISM OF ACTION

- INHIBITION OF CELL WALL SYNTHESIS e.g. Penicillins, Cephalosporin
- INHIBITION OF PROTEIN SYNTHESIS e.g. Macrolides, Tetracyclines
- INHIBITION OF DNA SYNTHESIS e.g. Quinolones.
- INHIBITION OF FOLATE METABOLISM e.g. Sulphonamides, Trimethoprim
- INHIBITION OF RNA synthesis by binding to RNA polymerase e.g. Rifampicin.

According to spectrum

- **Narrow spectrum , e.g.:**

  penicillin G , aminoglycosides

- **Broad spectrum , e.g.:**

  ampicillin , amoxicillin

Choice of Antibiotic

A)Clinical diagnosis
(e.g.,syphylis)

B)Microbiological information

C)Pharmacological consideration

B)Bacteriological informations

Advantages

- The exact antibiotic to be used
- The most effective and reject the one with little or no activity
- The least toxic
- The cheapest

Disadvantages

- The bacteria isolated may not be the prime cause of the disease.
- do not take in consideration site of infection
- some bacteria cannot be cultivated or take time to grow

  (e.g. M. Leprae, M. Tuberculosis)
- Bacteriological services are not available at all hospitals

Choice of Antibiotics(cont.)

C) Pharmacological consideration

1. Site of infection

2. Host factors

a) Immune system e.g. Alcoholism, diabetes, HIV, malnutrition, advanced age- (higher than usual doses or longer courses are required).

b) Genetic factors

e.g. Patients with G-6-PD deficiency treated with sulfonamides and chloramphenicol (Hemolysis)

Choice of Antibiotics (Cont.)

c) Pregnancy and Lactation

Aminoglycosides (hearing loss)

Tetracyclines (bone deformity)

d) Age of the patient

e.g. Grey baby Syndrome (chloramphenicol)

e) Renal function

e.g. Aminoglycosides (renal failure)

f)Liver function

e.g. Erythromycin(hepatic failure)

Choice of Antibiotics (Cont.)

3. Drug Allergy

4. Potential Side Effects (Drug safety)

Chloramphenicol (a plastic anaemia)

Fluoroquinolones in children&Preg.(tendon damage)

5. The cost of therapy

Emperic therapy?

MISUSES OF ANTIBIOTICS

- Treatment of untreatable infections (wrong diagnosis)

  e.g. viral infections
- Improper dosage.
- Therapy of fever of unknown origin.
- Presence of pus or necrotic tissues , or blood at the surgical site
- Excessive use of prophylactic antibiotics in travelers.
- Lack of adequate bacteriological information.

Bacterial Resistance

- One result of the widespread use of antibiotics has been the emergence of resistant pathogens that have been sensitive in the past.

Definition

Conc of antibiotic required to inhibit or kill the bacteria is greater than the conc that can safely be achieved in the plasma.

Mechanisms of Acquired Antibiotic Resistance

1. Inactivation by enzyme produced by bacteria

Bacterial β-lactamase inactivates penicillins & cephalosporins by cleaving the β-lactam ring of the drug.

2. Bacteria develops an altered receptor for the drug

3. Bacteria develops an altered metabolic pathway

4. Reduced bacterial permeability to antibiotic

5. Actively transporting the drug out of the cell

Prevention of Resistance

*Use antibiotics only when absolutely required

*Use antibiotics in adequate dosage for sufficient period of time

Not too brief therapy

Not too prolonged therapy

(exceptions, e.g. TB)

*Combination of antibiotics may be required to delay resistance (e.g. TB)

General Principles of Chemotherapy

- **Administer drug in *full dose*, at *proper interval* and by the b*est route***
- **When apparent cure achieved , continue antibiotic for about 3 days further to avoid relapse**
- **Skipping doses may decrease effectiveness of antibiotic & increase the incidence of bacterial resistance.**

General Principles of Chemotherapy(cont)

- Two or more antimicrobials should not be used without good reason, e.g.:
  - Mixed bacterial (polymicrobial) infections
  - Desperately ill patient of unknown etiology
  - To prevent emergence of resistance (e.g. TB)
  - To achieve synergism
    eg.piperacillin+gentamicin(p. aeruginosae)

Disadvantages of multiple antibiotics

- Increased risk of sensitivity or toxicity
- Increased risk of colonization with a resistant bacteria
- Possibility of antagonism
- Higher cost

General principles (Cont.)

- In some infections bacteriological proof of cure is desirable (e.g. TB, UTI)
- Measurement of plasma conc. of antibiotics is seldom
- needed, except. streptomycin in renal TB; I.M gentamicin

Indications for antibiotics prophylaxis

Surgical prophylaxis

bowel surgery, joint replacement, and some gynecological interventions to prevent postoperative infections.

Immunosuppressed Patients

Very old, very young

Diabetics, Anaemics, AIDS pts ,Cancer pts.

Dental extractions

Pts with total joint replacements

Pts with cardiac abnormalities