

Introduction to Antibiotics

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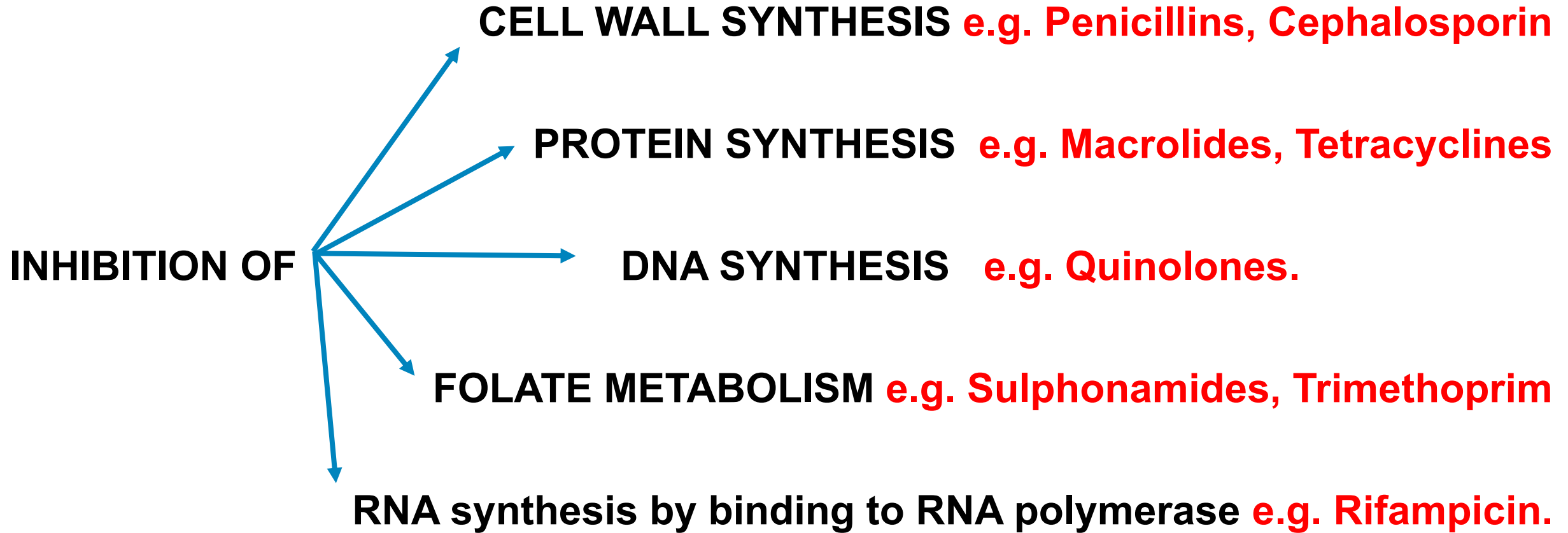
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(Slides are adopted and modified from Prof. Mohammad Alhumayyd)

Definition of Antibiotics

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





According to spectrum

- **Narrow spectrum, e.g.:**
penicillin G, aminoglycosides

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

Choice of Antibiotic



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

**B) Microbiological
information**

**C) Pharmacological
consideration**





B) Bacteriological information

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- (requires higher doses or longer courses)

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 (plastic anemia)

Fluoroquinolones in children & Pregnancy (tendon damage)

5. The cost of therapy

Empiric 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

Antibiotic concentration that is required to inhibit or kill the bacteria is greater than the concentration 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

- ❖ Administer drug in *full dose*, at *proper interval* and by the *best 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 (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 e.g. piperacillin + gentamicin (*p. aeruginosa*)

- ❖ **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/young
- Diabetics
- Anaemics
- AIDS
- Cancer

Dental extractions

Pts with total joint replacements
Pts with cardiac abnormalities