Pharmacology
Team 437

MED437
KING SAUD UNIVERSITY

Respiratory Block

8 Antibiotics

Objectives:

At the end of lecture, the students should be able to understand the following:

- Classification of antibiotics.
- Misuses of antibiotics.
- Choice of antibiotics.
- Bacterial resistance and ways to prevent it.
- General principles of chemotherapy.
- Indications for antibiotics prophylaxis

Color index:

Red: important

Grey: Notes or extra information

green: dr's note

تمت المراجعة
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و
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ANTIBIOTICS

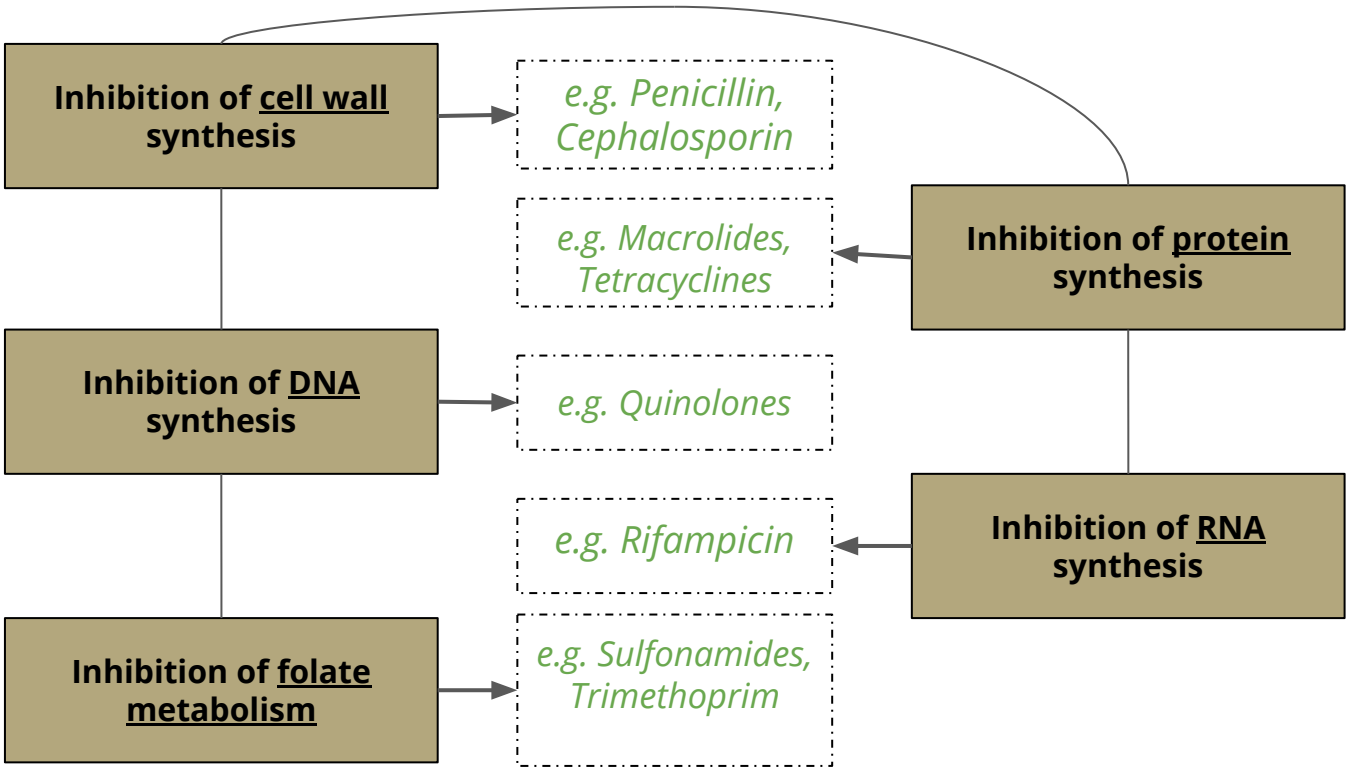
Chemical substances produced by various microorganisms (bacteria, fungi, actinomycetes) that have the capacity to inhibit or destroy other microorganisms.

Nowadays they are chemically synthesized.

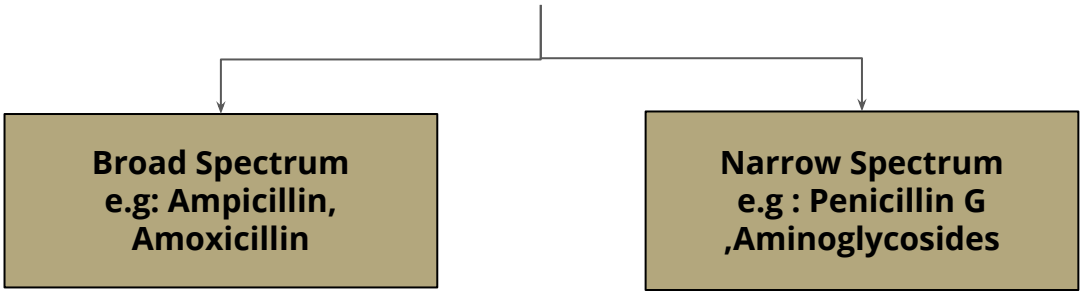
They either kill bacteria **(bactericidal)** or keep more bacteria from growing**(bacteriostatic).**

Antibiotics will not cure infections caused by viruses.

Classification of antibiotics according to their mechanism of action



Classification of antibiotics according to Spectrum



Choice of Antibiotics

1- Clinical diagnosis :

e.g. syphilis . The symptoms of syphilis are known, the causing agent is also known "Treponema pallidum" , the best antimicrobial agent is usually penicillin . In this case, you can go ahead and prescribe.

2- Microbiological information

Advantages	Disadvantages
•The exact antibiotic to be used, through studying the sensitivity of the infecting organisms to antibiotics •The most effective & reject the one with little or no activity •The least toxic •The cheapest	•The bacteria isolated (and cultured in microbiology lab) may not be the prime cause of the disease. •Do not take in consideration the site of infection. in vitro, they choose the concentration of the antibiotic as it is proper in plasma, this doesn't apply to infections in other sites in the body e.g. bone, urinary tract. •Some bacteria can not be cultivated or take time to grow (M. leprae, M. tuberculosis) •Bacteriological services are not available at all hospitals, due to the high expenses.

3- Pharmacological consideration

Drug Factors	Patient factors
a- Site of infection **b- Mode of administration** **c- Potential Side Effects** (Drug safety) Chloramphenicol (aplastic anaemia) Flouroquinolones (cartilage damage) **d- The cost of therapy**	**a) Immune status** (Alcoholism, diabetes, HIV) **b) Genetic factors** Patients with G-6-PD deficiency with sulfonamides or chloramphenicol **c) Pregnancy and Lactation (contraindicated)** Aminoglycosides (hearing loss) Tetracyclines(bone deformity) **d) Age :** Old patients tend to have decreased renal functions; infants have poorly detoxification mechanisms **e) Renal Disease (contraindicated)** e.g. Aminoglycosides (renal failure) **f) Hepatic disease (contraindicated)** e.g. Erythromycin (hepatic failure)

General Principles of Chemotherapy

When apparent cure achieved , continue antibiotic for about 3 days further to avoid relapse

Administer drug in full dose, at proper interval and by the best route

Skipping doses may decrease effectiveness of antibiotic & increase the incidence of bacterial resistance.

In some infections bacteriological proof of cure is desirable. (e.g. TB, UTI)

Measurement of plasma conc. of antibiotics is seldom needed, except for systemic aminoglycosides(e.g., streptomycin, gentamicin, etc.).

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(pseudomonas aeruginosae)

Disadvantages of multiple antibiotics

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

Bacterial resistance

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

When does bacterial resistance emerge? One result of the widespread use of antibiotics has been the emergence of resistant pathogens that have been sensitive in the past.

Mechanisms of Acquired Antibiotic Resistance

- Inactivation by enzyme produced by bacteria. Bacterial β-lactamase inactivates penicillins & cephalosporins by cleaving the β-lactam ring of the drug.
- Bacteria develops an altered receptor for the drug.
- Bacteria develops an altered metabolic pathway.
- Reduced bacterial permeability to antibiotic through cell membrane.
- Actively transporting the drug out of the bacterial cell.

Prevention of Resistance

- Use antibiotics only when absolutely required
- Use antibiotics in adequate dosage for sufficient period of time
  - Not too brief therapy[1]
  - Not too prolonged therapy[2] (exceptions, e.g. TB)
- Combination of antibiotics may be required to delay resistance (e.g. TB)

[1]:Even after symptoms disappear, bacteria mayn't have eradicated completely. Thus, patient should continue the course of treatment to avoid relapse & resistance.

[2]:Prolonged therapy may cause eradication of healthy bacteria or opportunistic infection by C. difficile (Pseudomembranous colitis)

Misuses of Antibiotics

- Treatment of diseases caused by viruses.
- Improper dosage.
- Therapy of fever of unknown origin.
- Presence of pus or necrotic tissue , or blood at the surgical site.
- Excessive use of prophylactic antibiotics in travelers.
- Lack of adequate bacteriological information.
- Overuse as growth promoters in animals and agriculture.
- Patients do not take them according to their doctor's instructions.
- Some patients save unused antibiotics for another illness, or pass to others.

Indications for antibiotics prophylaxis

Surgical prophylaxis	Immunosuppressed patients	Dental extraction
bowel surgery, joint replacement, and some gynecological intervention to prevent postoperative infections.	very old, very young, diabetic, Anaemics, AIDS and cancer patients	In patient with total joint replacement And patients with cardiac abnormalities

MCQs

1. Which of the following agents is considered a narrow spectrum antibiotic?
   a. Ceftriaxone.
   b. Ciprofloxacin.
   c. Aminoglycosides.
   d. Imipenem.
2. A 58-year-old male with a history of hepatitis C, cirrhosis, and ascites presents with spontaneous bacterial peritonitis. Which of the following antibiotics requires close monitoring and dosing adjustment in this patient given his liver disease?
   a. Penicillin G.
   b. Tobramycin.
   c. Erythromycin.
   d. Vancomycin.
3. In the treatment of a urinary tract infection in a patient known to have a deficiency of glucose-6-phosphate dehydrogenase, it would not be advisable to prescribe which of the following?
   a. Sulfonamide
   b. Amoxicillin
   c. Cephalexin
   d. Ciprofloxacin
4. Which of the following inhibit RNA synthesis?
   a. Rifampicin
   b. Quinolones
   c. Macrolides
   d. Aminoglycosides
5. Which of the following inhibit folate metabolism
   a. Tetracyclines
   b. Trimethoprim
   c. Ampicillin
   d. Cephalosporin

SAQs

1. A 52-year-old man came to the ENT doctor. He has a sore throat, cough, runny nose and sneeze. The doctor examines him and finds out that it's a normal cold, and the patient incest to take antibiotics. The doctor prescribes him antibiotics for 5 days.

   a. What is the most probable organism that cause his condition?
   b. What could happen as a result?

2. A 63-year-old man with a renal failure what antibiotic should be avoided ?

Answers:

1. C
2. C
3. A
4. A
5. B

Answers:

1.
   a. Virus
   b. The bacteria can acquire antibiotic resistance
2. Aminoglycosides

Good Luck & Thank you !

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