



Antibiotics

- Red : important
- Black : in male / female slides
- Pink : in female's slides only
- Blue : in male's slides only
- Green : females doctor notes
- Grey: males doctor notes, extra

OBJECTIVES:

By the end of this lecture, students should be able to:

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

Editing File

Antibiotics :

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

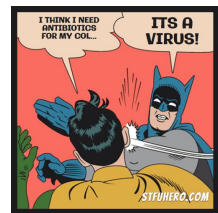
bacteriostatic
hold bacteria from growing.



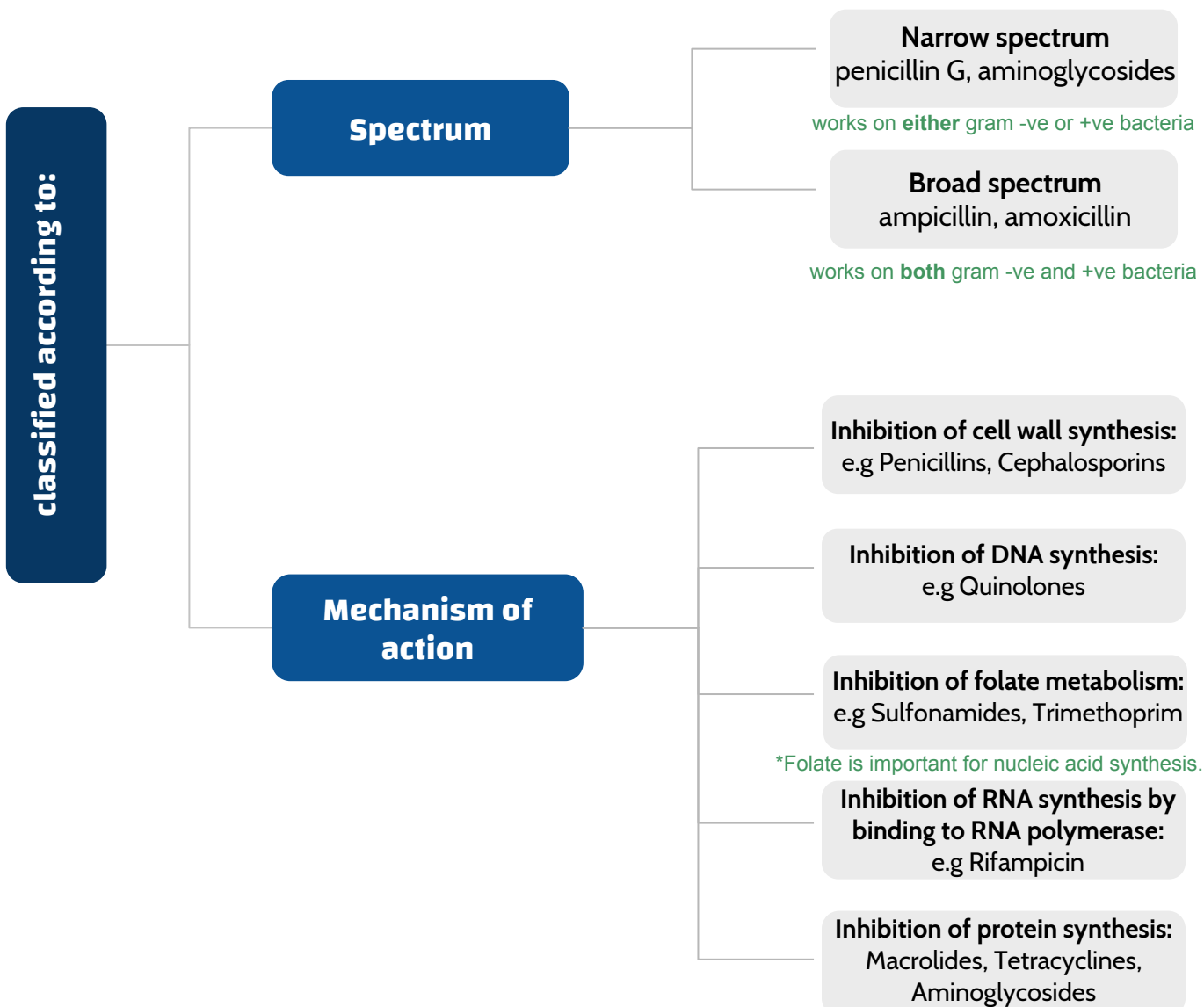
bactericidal
kill the bacteria.

Note that:

- Nowadays they are chemically synthesized.
- They will not cure infections caused by viruses.



CLASSIFICATION OF ANTIBIOTICS:



Choice of Antibiotic:

1

Clinical diagnosis:

e.g. Syphilis

2

Microbiological information: a culture for the bacteria is done to test the sensitivity

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.

Advantages: ✅

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

3

Pharmacological consideration:

1-Site of infection.

It's very important to know whether the antibiotic can reach the site of infection or not.
E.g: 1st and 2nd generations of cephalosporins can't cross BBB so can't treat meningitis.

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

- **Liver function:**
e.g. **Erythromycin** (hepatic failure)

3-Host factors :

- **Genetic factors:**
e.g. Patients with G-6-PD deficiency treated with **sulfonamides** (**Hemolysis**).

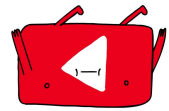
- **Extreme Age:**
Neonates and elderly

2-Drug Allergy.

- **Pregnancy and Lactation:**
e.g **Aminoglycosides** (hearing loss) "ototoxicity"
Tetracyclines (bone deformity in the child) because tetracycline bind to calcium and affects the bones and teeth

- **Renal function:**
e.g **Aminoglycosides** (renal failure)

Bacterial resistance



Definition:

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.

Misuse of Antibiotics:

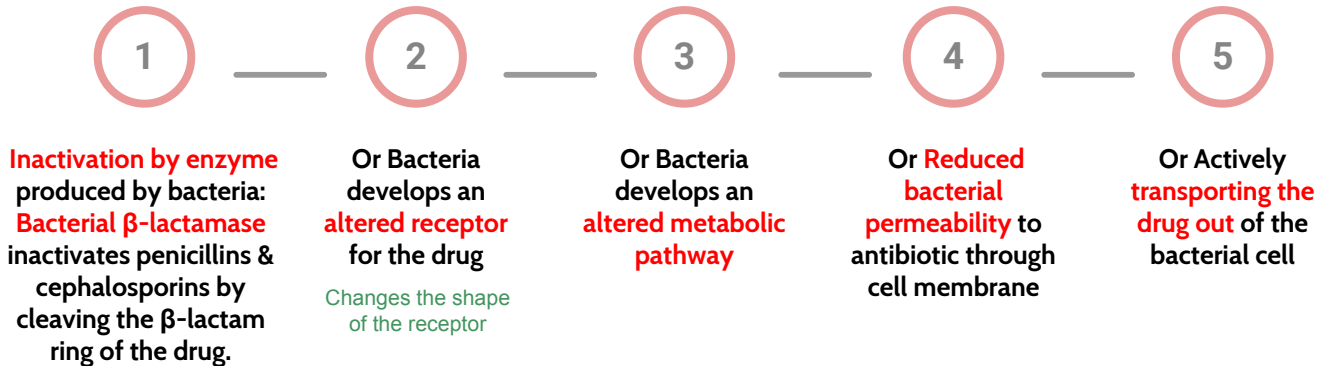
- Treatment of diseases caused by viruses.
- Improper dosage.
- Therapy of fever of unknown origin.
- Presence of pus or necrotic tissue , or blood at the surgical site. *“This can prevent the absorption of antibiotics so drainage should be done first”*
- Excessive use of prophylactic antibiotics in 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.

Reasons for Misuse of Antibiotics

- Availability of a very wide selection.
- Limitation of physician’s time.
- Physician shortage and expenses.
- Availability without prescriptions in pharmacies.
- Public demand (pressure to prescribe).

Mechanism of Acquired Antibiotic Resistance:

the bacteria chooses one of those methods to develop the resistance

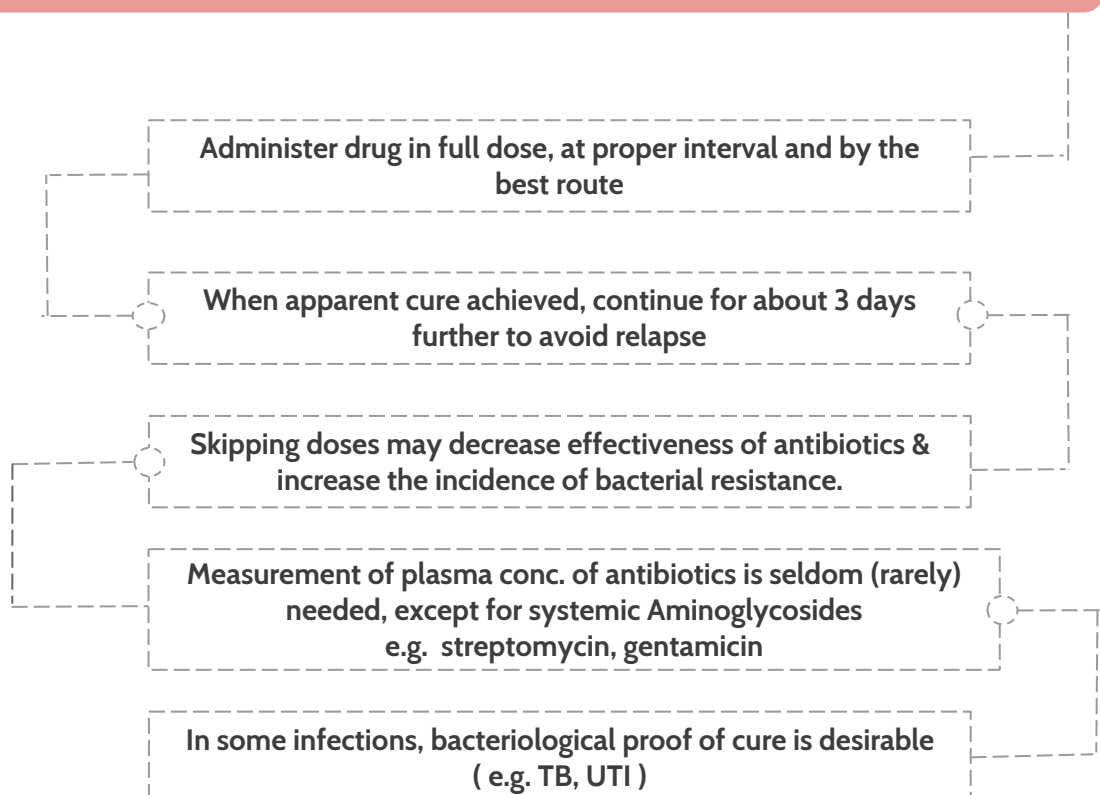


Prevention of bacterial resistance:



- Use antibiotic 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 \rightarrow 6 months).
- Combination of antibiotics may be required to delay resistance. (e.g. TB)

General principles of Antibacterial therapy:



1 disadvantages:

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

Usage of multiple antimicrobial

2 Exceptions where combining antibiotics is a good option:

- 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 aeruginosa)

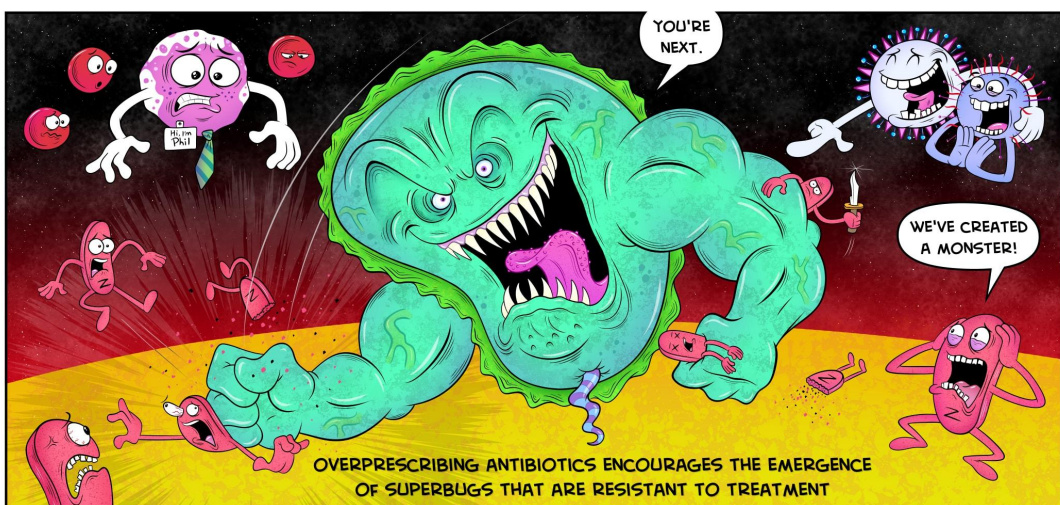
Antibiotic synergy is when two or more antibiotics are used simultaneously to treat an infection. In the synergistic response, the applied antibiotics work together to produce an effect more potent than if each antibiotic were applied singly.

Indications for Antibiotics Prophylaxis:

Surgical prophylaxis	Immunosuppressed Patients	Dental extractions <i>controversial</i>
<ul style="list-style-type: none"> • bowel surgery, joint replacement, etc. to prevent postoperative infections. 	<ul style="list-style-type: none"> • Very old • Very young • Diabetics • Anaemics • AIDS • Cancer pts 	<ul style="list-style-type: none"> • Pts with total joint replacements • Pts with cardiac abnormalities

Advice:

Frequent and inappropriate use of antibiotics can cause bacteria or other microbes to change so antibiotics don't work against them.
DON'T take antibiotics unless the doctor prescribed it for you.



QUIZ

MCQs:

- 1- Antibiotics treat infections from?
A-viruses B-Bacteria C-Virus and Bacteria
- 2-If your doctor prescribes antibiotics, you should keep taking the pills until you feel better.
A-True B-False
- 3-Which of these antibiotics inhibit cell wall synthesis?
A-Fluoroquinolones B-Tetracycline C-Penicillin
- 4-Bacteria developed beta-lactamase as a mechanism of resistance to beta-lactam antibiotics. What is the mechanism of resistance?
A-Inactivation by Enzyme B-Developing an altered receptor for the drug C-Altered metabolic pathway
- 5-When choosing an Antibiotic there are three steps to take in consideration, clinical diagnosis, microbiological information, and pharmacological consideration. What is the advantage of microbiological information?
A-Do not take in consideration the site of infection B-The bacteria isolated may not be the prime cause of the disease C-Tell us the exact antibiotic to be used

Answers: 1)B -2)B -3)C -4)A -5)C

SAQ:

- 1-2.A 35-year-old male came to the clinic with skin rash ,sores in his mouth, fever and weight loss after investigations the diagnose was syphilis.
Q1.Which antimicrobial drug is best to prescribe in this case ?
Q2.What is the mechanism of action of that drug?
- Q3.A 63-year-old man with a renal failure what antibiotic should be avoided ?
- Q4.A 17-year-old female came to the emergency with sore throat, cough, runny nose and sneeze after examination the doctor find that she has a common cold. Is there a need to prescribe an antibiotic in this case? Why ?
- Q5.Mention three conditions in which more than one antibiotic need to be use ?

Q1.Penicillin

Q2.Inhibition of cell wall synthesis

Q3.Aminoglycosides

Q4.No, because it causes by viruses and the antibiotics not using in treatment of diseases caused by viruses because the bacteria can acquire antibiotic resistance.

Q5.Mixed bacterial (polymicrobial) infections - Desperately ill patient of unknown etiology - To prevent emergence of resistance (e.g. TB)



GOOD LUCK

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Sources:

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