

Introduction to Antibiotics

Objectives:

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



و اعلموا ان مهمتكم ليست في ورقة
تناولونها ولكن مهمتكم في امة تحيونها

- Titles
- Very important
- Extra information
- Doctor's notes

Definition:

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

- *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:

They can be classified according to:

1-Mechanism of action:	2-Spectrum
A-Inhibition of CELL WALL SYNTHESIS e.g. Penicillins, Cephalosporin	A-Narrow spectrum (Acting on one group either Gram +ve or Gram -ve) e.g. Penicillin G (Acts on Gram +ve) Aminoglycosides (Act on Gram -ve)
B-Inhibition of PROTEIN SYNTHESIS e.g. Macrolides, Tetracyclines	
C-Inhibition of DNA SYNTHESIS e.g. Quinolones.	B-Broad spectrum (Acting on both Gram +ve or Gram -ve) e.g. Ampicillin , Amoxicillin
D-Inhibition of FOLATE METABOLISM e.g. Sulphonamides, Trimethoprim	(Usually used if you don't know which bacteria caused the infection and it's called empiric treatment which means: Using the antibiotic before knowing the type of bacteria).
E-Inhibition of RNA SYNTHESIS (by binding to RNA polymerase) e.g. Rifampicin.	

Choice of Antibiotic:

1-Clinical diagnosis:

It means you can know the only disease by clinical diagnosis.

e.g. Syphilis (الزُّهري) : Its symptoms are known and it is caused by (*Treponema pallidum*) which is sensitive to penicillin, So you can prescribe it.

2-Pharmacological Consideration:

A-Site of infection. (e.g. in the brain we need drug cross BBB)

B. Host factors:

*Immune system :

e.g. Alcoholism, diabetes, HIV, malnutrition, advanced age (**higher than usual doses or longer courses are required**). (يعني اللي مناعتهم ضعيفه)

* Genetic factors:

e.g. Patients with **G-6-PD** deficiency treated with sulfonamides (**G-6-P** is an enzyme that protect the RBC from getting destroyed, So any oxidizing drug will interfere with its function and result in **Hemolysis**)

*Pregnancy and Lactation :

Aminoglycosides may cause (**hearing loss**) and Tetracyclines may cause (**bone deformity**)

***Extreme Age (Neonates and elderly)** (عشان الكبد و الكلي ماتشتغل زين عندهم)

*Renal function

e.g. Aminoglycosides (**renal failure**)

(هذا النوع من الادوية تطلع عن طريق الكلى مب الكبد عشان كذا اللي عندهم مشكلة في الكلى تزيد السمية في الدم)

*Liver function

e.g. Erythromycin (**hepatic failure**) (نفس فكرة اللي قبل)

C. Drug Allergy(eg. penicillin (parenteral) we need to do skin test) .

3-Microbiological information: (Bacteriological information)

In case you don't know the bacteria or you know the bacteria but you don't know the sensitivity.

Advantages:	Disadvantages:
<ul style="list-style-type: none">*The exact antibiotic to be used*The most effective and reject the one with little or no activity*The least toxic*The cheapest	<ul style="list-style-type: none">*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.

Misuses of antibiotics:

- *Treatment of diseases caused by viruses.
- *Improper dosage. (The dose is not enough or it didn't take enough time)
- *Therapy of fever of unknown origin.
- *Presence of pus or necrotic tissues , or blood at the surgical site (The pus could block the antibiotic so first we need to remove the pus then give the antibiotic)
- *Excessive use of prophylactic antibiotics in travelers.
- *Lack of adequate bacteriological information.
- *Over use as growth promoters in animals and agriculture.
- *Patients do not take them according to their doctor's instructions. (Usually the symptoms went before the bacteria die so the patient stop taking the antibiotic then it came back again with resistance)
- *Some patients save unused antibiotics for another illness, or pass to others.



Reasons for Misuses of Antibiotics :

- 1-Availability of a very wide selection.
- 2-Limitation of physician's time.
- 3-physician shortage and expenses.
- 4-availability without Rx in pharmacies.
- 5-public demand (pressure to prescribe).

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. (البكتيريا تفرز انزيمات تثبط المضادات الحيوية)

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 . (تمنع التأثير عن طريق اخراج المضاد خارج البكتيريا)



Prevention of Resistance :

*Use antibiotics only when absolutely required (في حالات البكتيريا)

*Use antibiotics in adequate dosage for sufficient period of time.

“Not too brief therapy, Not too prolonged therapy”

(exceptions, e.g. TB) (تحتاج وقت طويل للعلاج)

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

(الأفضل ان يستخدم نوع واحد من المضادات لكن في حالات خاصة نحتاج اكثر من نوع للقضاء على البكتيريا)

General Principles of Chemotherapy:

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.

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

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

General Principles of Chemotherapy (cont.) :

Two or more antimicrobials should not be used without good reason due to its risky disadvantages :-

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

However, sometimes we need to use multiple antibiotics , 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 used for (p.aeruginosae)).

Indications for antibiotics prophylaxis:

Surgical prophylaxis	bowel surgery, joint replacement , etc. to prevent <u>postoperative</u> infections.
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Immunosuppressed Patients	Very old, Very young , Diabetics, Anaemics , AIDS ,Cancer pts.
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Dental extractions	Pts with total joint replacements. Pts with cardiac abnormalities.
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عبدالعزيز رضوان	اللولو الصليهم
مؤيد أحمد	روان القحطاني
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