

## Unit 9 – Pharmacy

### Definitions

**Administration:** to provide something.

**Botany:** the part of biology that studies everything about plants, such as their structure, classification, properties, diseases and interaction with the environment.

**Catalyst:** a substance that increases the rate of a chemical reaction

**Diffusion:** spread out over a large space.

**Dosage:** the amount and how often you should take a medication or drug.

**Enzyme:** work to speed up chemical reactions.

**Herbs:** a plant or a part of a plant that is used to make medicines.

**Prescription:** a written message from a doctor that officially tells someone to use a medicine.

**Dispensing:** giving drugs or medicines following what a doctor has written or recommended

**Side effect:** an often harmful and unwanted effect of a drug; this normally happens along with the desired effect.

### History of pharmacy

Pharmacy is the science of collecting, preparing and dispensing drugs. It combines medical science, chemistry and biology. It studies drug action and the effects that those drugs have on our body.

- ❖ The first time it was discovered that a person was treated using a drug, was in ancient (old) Greece by Asclepius and Hygeia. It is said that they used a plant to treat a wound (injury).
  - ❖ In ancient (old) Egypt, India and China, physicians (doctors) started treating sick people using natural plants and herbs.
  - ❖ In ancient Egypt a small separation between pharmacy and medicine happened. It was decided that some physicians would visit sick people and other physicians would prepare treatments and wait for sick people to visit them, But this separation was more official in the golden age of Islam ( 8<sup>th</sup> to 14<sup>th</sup> century).
  - ❖ Muslim scientists and physicians had a lot of knowledge in chemistry and botany. This helped them discover different ways of preparing medicines, they also wrote a lot of books, which were later used by scientists in Europe. The first one of them was Al Razi.
  - ❖ In the 16th century, a law (rule) was created that didn't allow doctors (physicians) to prepare medicines for their patients. Pharmacists were the only professionals allowed to prepare medicines.
  - ❖ A Pharmacist is a healthcare professional specialised in preparing, using, storing and providing medicine.
- 1) Which of the following is True?
    - a) Al Razi was the first Greek scientist
    - b) Asclepius separated doctors from pharmacists
    - c) There is one type of pharmacy
    - d) The books written by Muslim scientists were used later in Europe.

## ❖ Types of Pharmacists:

- Community pharmacist – pharmacists who work in a pharmacy where you would go to buy medicines.
- Clinical pharmacist – pharmacists who work in hospitals with doctors and nurses. They decide and advice which treatment each patient needs to improve. They can also specialise in different areas, such as oncology (cancer), geriatric (old age), paediatric (infants and children) and psychiatry (mental health disorders).
- Home care pharmacist – pharmacists who are responsible for preparing and sending medication to people who are home as they are very sick or old.
- Research pharmacist – pharmacists who develop new drugs.

## Pharmacology

Pharmacology is the science that studies everything related to drugs. What drugs are made of, how those work in the body, their effects and interactions.

## ❖ Pharmacology is divided into two different areas of study:

- Pharmacokinetics: the study of what happens to drugs once they enter the body. It includes:
  - Absorption: how the medicine gets into the body
  - Distribution: where the medicine goes in the body
  - Metabolism: what the body does to the medicine
  - Excretion: how the body gets rid of the medicine
- Pharmacodynamics: the study of what the drug does to the body, what receptors are activated, what other effects does the drug have. The factors that influence pharmacodynamics are:
  - Patient age
  - Disease type
  - Pregnancy
  - Other drugs in the body

## ❖ Receptors are the parts of a cell that connect to a substance and cause a chemical reaction in that cell. If they are on the outside, they are known as cell surface receptors. If they are on the inside, they are known as intracellular receptors.

Agonist: drug connects to a receptor and produces an effect. Can be Full or partial.

Antagonist: drug connects to a receptor, but there is no effect.

## ❖ Drug: a chemical substance that is taken from a plant, animal, microorganisms or minerals. They are NOT used directly as a treatment.

Medicine: a result of a drug or drugs being mixed, with or without an excipient. are used directly as a treatment, for example: medicines can treat a pain or cure an infection.

Excipients are used when making medicines. An excipient helps formulating, protecting or supporting a medicine. Excipients make medicines safer for us to use. Most medicines have excipients added to them.

2) Which of the following gives maximum effect when connecting to a receptor?

- a) Partial agonist
- b) Full agonist
- c) Partial antagonist
- d) Full antagonist

3) Which of the following is the inactive component of a medicine?

- a) Antagonist
- b) Drug
- c) Excipient
- d) Agonist

4) Which of the following can be given directly for treatment?

- a) Medicine
- b) Drug
- c) Excipients
- d) Agonist

5) Which of the following describes how a medicine is removed from the body?

- a) Excipient
- b) Excretion
- c) Pharmacodynamics
- d) Metabolism

6) Which of the following describes what the drug does to the body?

- a) Absorption
- b) Metabolism
- c) Pharmacodynamics
- d) Distribution

7) Which of the following factors influence the drug's effects on the body?

- a) Pharmacokinetics
- b) Excipient
- c) Patient's gender
- d) Disease type

## Classes of drugs

❖ A Drug has three different names:

- Chemical name: the first name given to a drug when discovered. This name describes the structure of the drug. They are usually very long and often too difficult to remember or pronounce. Therefore, the chemical name is not often used.
- Generic name: the name the drug will be commonly known as. Ex: amoxicillin, paracetamol, metformin and ibuprofen.
- Brand name: the name developed by the company who create the drug. The name must be unique, so they cannot be mistaken for another. Brand names are usually catchy and often relate to the use of the drug. Examples of brand names are:  
Skelaxin – relaxes skeletal muscles ,,, Lopressor – lowers blood pressure,,, Glucotrol – controls blood glucose.

- ❖ Drugs usually belong to a certain group. Drug groups generally reflect what the drug does or the area of the body it affects.

1. **Pain killers:** used to manage pain. The type of painkiller used depends on the type of pain you have. Painkillers interfere with (stop) the nerve pathway which carry pain messages to the brain and change the way you feel pain.

- Paracetamol (generic name), it has few side effects, it relieves pain and reduces fever. Used to treat conditions like Headaches, muscle aches, arthritis, backaches, colds, fever.

2. **Non-steroidal anti-inflammatory drugs (NSAIDs):** relieve or reduce aches and pains caused by inflammation. NSAIDs are easy to buy without a prescription from a doctor. Taking high doses of NSAIDs for a long period of time can cause ulcers to develop in the stomach. You should never take more than one type of NSAID at the same time.

**\*Remember\*** Heat, redness, swelling and pain are all signs and symptoms of inflammation.

- Ibuprofen (generic name) used to treat conditions like: Toothache, migraines, pain, fever, arthritis, swelling.

3. **Antihistamines:** used to treat allergies, motion sickness and reactions to bites and stings. Most antihistamines can be bought easily, but some are only available on prescription. They come in different forms, including tablets, capsules, liquids, creams, eye drops and nasal sprays.

**\*Remember\*** Histamine is a chemical that is released when the body detects something harmful. Antihistamines stop these substances.

8) Which of the following is a generic name?

- a) Metformin
- b) Antihistamine
- c) Skelaxin
- d) Panadol

9) Ahmad has a red, hot swelling on his knee. He tells you that it is painful. What medication would you advise him to take?

- a) Amoxicillin
- b) Antibiotics
- c) Ibuprofen
- d) Panadol

10) Which of the following is True about chemical names of medicines

- a) Too short
- b) First name given to a medicine
- c) Developed by the company who create the drug
- d) Commonly used in clinical practice

11) What effect does “Glucotrol” have on the body?

- a) Lowers blood glucose
- b) Elevates blood glucose
- c) Lowers blood pressure
- d) Reduces pain

## Routes of administration

The route of administration tells us how the drug has entered the body. Each drug has a specific method in which it should enter the body. Ex: oral (tablets), inhaler, topical (creams), intravenous. Routes can affect the absorption of a drug.

❖ The route used depends on three main factors:

- What part of the body is being treated
- How the drug works within the body
- The formula of the drug

1. Oral: it's where the patient takes medication through the mouth. Most commonly used. Are usually pills or capsules. The oral medication gets broken along its way to the intestine where it gets absorbed to the bloodstream. Once in the blood, it can act on many organs.

| Advantages                                             | Disadvantages                       |
|--------------------------------------------------------|-------------------------------------|
| Easiest, safest and most cost-effective                | Food can affect drug absorption     |
| Stable drugs: provide an accurate dose for the patient | Slower absorption than other routes |
| Slow release forms available                           |                                     |

2. Sublingual & Buccal: also given through the mouth, but are not commonly used. Can be used in cases of emergencies (very fast absorption). These areas have a lot of small blood vessels where the drug gets dissolved and absorbed to the blood without going through the digestive system.

- Sublingual is put under the tongue
- Buccal is placed between gum and cheek

| Advantages                                                                   | Disadvantages                                                      |
|------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Lower doses can be given                                                     | Can be uncomfortable to hold the drug in the mouth for a long time |
| Works if the patient cannot swallow                                          | Patient can accidentally swallow                                   |
| Doesn't have the usual side effects (ex: nausea) that happen with oral route | Cannot eat or drink while the medicine is in the mouth             |

3. Topical: in the form of cream or gel directly applied to the area that needs treatment. It includes areas such as the skin, eyes, ears and nose.

| Advantages                                         | Disadvantages                                |
|----------------------------------------------------|----------------------------------------------|
| Easy to apply for any age                          | Absorption can be slow                       |
| Good if treatment is needed only for specific area | Creams and ointments can stain on clothes    |
| Low risk of drug interaction                       | Not well absorbed into deeper layers of skin |

4. Parenteral: most commonly using injections. There are 4 types:

- Intradermal: drug injected into layers of skin. Ex: BCG vaccination
- Intravenous: drug injected into vein blood stream. Ex: morphine
- Subcutaneous: drug injected into fat layer under the skin. Ex: insulin
- Intramuscular: drug injected into the muscle. Ex: paracetamol

| Advantages                            | Disadvantages                                                 |
|---------------------------------------|---------------------------------------------------------------|
| Fast, suitable for emergency          | Require aseptic conditions, and preparation should be sterile |
| Can be used in unconscious patients   | More expensive                                                |
| Good alternative when oral don't work | Can be uncomfortable to the patient                           |
|                                       | Most injections cannot be self-administered                   |
|                                       | Can be dangerous if administered incorrectly                  |

| Route of administration | Time until effect           |
|-------------------------|-----------------------------|
| Oral                    | 20 minutes – 1 hour         |
| Sublingual and buccal   | 3-5 minutes                 |
| Topical                 | Variable (minutes to hours) |
| Subcutaneous            | 15-30 minutes               |
| Intravenous             | 30-60 seconds               |
| intramuscular           | 10-20 minutes               |

Routes of administration and forms of medication:

| Oral medication | Sublingual and buccal medication | Topical medication | Parenteral medication |
|-----------------|----------------------------------|--------------------|-----------------------|
| Capsules        | Small tablets                    | Creams             | Injections            |
| Liquids         | Films                            | Lotions            | Infusion              |
| Drops           | Wafers                           | Gels               |                       |
| Pastilles       | Sprays                           | Ointments          |                       |
| Powder          |                                  | Sprays             |                       |
|                 |                                  | Inhalers           |                       |
|                 |                                  | Liquids            |                       |

12) Which of the following routes of medicine administration is the best to use in emergency cases?

- a) Oral
- b) Topical
- c) Subcutaneous
- d) Intravascular

13) Which of the following routes of medicine administration is the least preferred when it comes to self-administration?

- a) Parenteral
- b) Topical
- c) Oral
- d) Sublingual

14) Which of the following is an oral medication?

- a) Ointments
- b) Inhalers
- c) Drops
- d) Injections

15) Sara has a small ulcer in her mouth which is causing her pain and discomfort, she was prescribed an ointment. What route of medicine administration is this?

- a) Intradermal
- b) Sublingual
- c) Oral
- d) Topical

16) Which of the following routes of medicine administrations is the most cost effective?

- a) Topical
- b) Oral
- c) Parenteral
- d) Buccal

17) Which route of administration is placed under the tongue?

- a) Buccal
- b) Sublingual
- c) Topical
- d) Oral

18) Choose the correct statement about routes of medicine administration

- a) Parenteral route is the cheapest
- b) Films is a type of topical medications
- c) If the patient swallow his sublingual tablet, don't use another one
- d) Intravenous route needs only 30 – 60 minutes to take effect

19) BCG vaccination is administrated via which of the following routes?

- a) Subcutaneous
- b) Intravenous
- c) Intramuscular
- d) Intradermal

## Antibiotics

They are medicines that destroy or slow the growth of bacteria, but Antibiotics cannot fight viral infections such as the common cold or COVID-19. Antibiotics can be oral, parenteral or topical.

❖ In the UAE, you can only get antibiotics with a prescription from the doctor. It is illegal to buy antibiotics without a prescription.

❖ Normally when bacteria multiply (become more) in the body, the immune system can kill them and fight the infection. However, sometimes the body's immune system cannot fight all the bacterial cells by itself. This is when antibiotics are used. When antibiotics are used properly, they can cure infection and they can save lives.

❖ Most antibiotics begin fighting bacteria within a few hours. It is important to complete the whole course of medication even after symptoms of the infection have improved. This means you should take all of the antibiotics that you have been prescribed by the doctor even if you feel well. By doing this, it reduces the risk that bacteria will become resistant to the antibiotics.

❖ Antibiotic overuse explains the growing number of bacteria that are becoming resistant to antibiotic medications.

❖ Conditions where antibiotics should be given are:

- disease unlikely to clear up without the use of antibiotics.
- disease could spread if not treated.
- where antibiotics can significantly speed up recovery time.
- where the risk of not prescribing antibiotics can lead to more dangerous complications.

❖ Antibiotics side effects also range from mild to life-threatening conditions, although these are very rare. The risk of feeling side effects are different from person to another. Some of the side effects caused by antibiotics are:

- Diarrhoea, nausea, vomiting and upset stomach
- Rash
- Kidney stones
- Blood clotting and blood disorders
- Bowel inflammation

20) Which of the following is True about antibiotics?

- a) They commonly cause vomiting and diarrhoea
- b) Overuse of antibiotics decrease antibiotic resistance
- c) Antibiotic use increases recovery time
- d) Never give antibiotics to treat a viral infection

21) Choose the correct answer. Antibiotics can be dispensed by the pharmacist without the need of a physician prescription.

- a) True
- b) False

22) How do antibiotics work?

- a) They attack the immune system
- b) They allow the bacteria to multiply
- c) They collaborate with the immune system against the bacteria
- d) They kill the viruses

## Measurements and Formulas

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| Measurements |                |
|--------------|----------------|
| Abbreviation | Meaning        |
| kg           | kilogram       |
| g            | gram           |
| mg           | milligram      |
| mcg          | microgram      |
| ml           | millilitre     |
| tsp          | Teaspoon (5ml) |

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| Prescriptions |                   |
|---------------|-------------------|
| Abbreviation  | Meaning           |
| Rx            | prescription      |
| ac            | before meals      |
| pc            | after meals       |
| prn           | as needed         |
| bid           | twice a day       |
| tid           | three times a day |
| qid           | four times a day  |

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| Routes of administration |               |
|--------------------------|---------------|
| Abbreviation             | Meaning       |
| IM                       | Intramuscular |
| IV                       | Intravenous   |
| PO                       | By mouth      |
| SC                       | Subcutaneous  |
| SL                       | Sublingual    |
| TOP                      | Topical       |

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| Volume      |             |
|-------------|-------------|
| 1000ml = 1L | 5000ml = 5L |

| Solids       |              |                |
|--------------|--------------|----------------|
| 1 kg = 1000g | 1g = 1000mg  | 1 mg = 1000mcg |
| 3 kg = 3000g | 4 g = 4000mg | 2 mg = 2000mcg |

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| Time            |                   |
|-----------------|-------------------|
| 60 sec = 1 min  | 60 min = 1 hour   |
| 180 sec = 3 min | 120 min = 2 hours |

❖ Number of tablets needed = Prescribed dose ÷ Stock strength

23) The doctor prescribed 120mg of a drug. The drug is only available in 30mg tablets. How many tablets should be given to the patient?

- a) 3
- b) 4
- c) 5
- d) 6

24) The doctor prescribed 5 tablets of a drug for a patient per day. The drug is only available in 40mg tablets. How many mg will the patient take per day?

- a) 8 mg
- b) 0.125 mg
- c) 200 mg
- d) 40 mg

❖ Amount of solution needed = Desired dose ÷ Stock strength x Stock volume

25) The doctor prescribed 120mg paracetamol liquid four times a day. The drug is available in 250mg/5ml. How much liquid is needed per dose?

- a) 2.4 ml
- b) 4.5 ml
- c) 5 ml
- d) 120 ml

❖ IV rate per min or hour = Total IV volume ÷ Time ( minutes or hours)

26) The doctor wants to administer intravenously an amount of 0.5 L of liquid X over a period of six hours. How much liquid is administered per minute?

- a) 0.083 L/min
- b) 0.083 ml/min
- c) 1.38 L/min
- d) 1.38 ml/min

27) The doctor wants to administer intravenously an amount of 1800ml of liquid X over a period of nine hours. How much liquid is administered per hour?

- a) 200 L/hour
- b) 200 ml/min
- c) 200 L/min
- d) 200 ml/hour

## Safety Measures

procedures taken to make sure that drugs are administered or taken in a safe way. This is to prevent any harm to the patient. When the patient takes the wrong medication at the wrong time or at the wrong dose, these errors can range from minor to fatal (very bad) effects.

❖ Pharmacists usually communicate verbally and in written form with patients. Good and clear communication between a pharmacist and a patient can help 1)ensure the patient's safety 2)avoid medication errors 3)guarantee a better treatment for the patient 4)build a good relationship between the pharmacist and the patient.

❖ Nurses are mostly involved in the administration of drugs in a hospital. At home, the administration of drugs can be given by a responsible person.

❖ To prevent errors from drug administration, you should follow the six rights rule.

1. **Right drug:** Always make sure you are using the correct drug every time you administer them.
2. **Right patient:** To avoid this, the caregiver should double-check the patient's name and date of birth when collecting and administering the drug.
3. **Right dosage:** the correct dose as directed by the doctor.
4. **Right route of administration:** the route prescribed by the doctor.
5. **Right time:** at the correct time as prescribed by the doctor. Thirty minutes before or after the prescribed time is acceptable. Be aware that some medication must be taken on an empty stomach and some medication should be taken with food.
6. **Right documentation:** If a nurse administers medication, they should make a record as soon as possible. This is so another nurse will not double the dose. This is also useful at home. You should record: When (what day and time) ,, What (medication, dose, route) ,, Any side effects.

❖ To safely store drugs, the following rules should be followed:

1. **Store all medication out of reach and sight of (far away) children**
2. **Think about products that you might not think of as medicines:** Vitamins, creams, eye drops, and hand sanitisers can all be harmful (bad) to children.
3. **Make sure that you close your medicine caps tightly after each use.** Many medicines have child-resistant caps. This makes it is harder for children to get into medicine bottles.
4. **Put medicine away after every use.**
5. **Make sure to check the best before dates on medicines. Dispose of them in a proper manner. Do not put them down the drain. Drugs that are out of date should be taken to a pharmacy.**
6. **Be careful in places you visit with a child.**

28) Regarding the six rights of drug administration, what does right documentation means?

- a) Read the instructions paper that comes with the drug before giving the drug
- b) Write down when and what drug has been given to the patient
- c) Give the drug to the right patient at the right time
- d) It's is a technique of drug administration

Good luck

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