

Definitions

Pharmacology

In Greek "pharmakon mean drug,"

دواء الأورام وتأثيرها

Pharmacology is the study of drugs and their effects on life processes. It is a fundamental science that sprang to the forefront of modern medicine with demonstrated success in treating disease and saving lives.

فارما / الأسيطة
4 م

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أي مان تستخدم
للتعديل أو اكتشاف جانب
مسيولوجي أو مرضي لصحة
المريض

Definitions Cont.

Drug : Drug is a chemical substance that is used for diagnosis, prevention, treatment WHO Definition: Drug is "Any substance used or intended to be used to modify or explore physiological system or pathological states for the benefit of the recipient"

Toxicology : Toxicology is the study of poisons and organ toxicity. It focuses on the harmful effects of drugs and other chemicals and on the mechanisms by which these agents produce pathologic changes, disease, and death.

دراسة السموم والتأثيرات لصناد
للأدوية

Drug Nomenclature

Chemical name — describes the chemical constituents of the drug

وصف المكونات الكيميائية
للدواء

الاسم الطبي

Generic name — assigned by the inventor who develops the drug

اسم رسمي = official name
مكتشف أو مخترع الدواء

Trade name — brand name given by the company to sell the drug (same drug in different names by different manufacturer)

الاسم التجاري الذي تعطيه
الشركة لبيع الدواء

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Chemical Name

- Gives exact chemical composition of the drug
- Describe the atoms or molecular structure
- Difficult to understand

Example - N-acetyl-para-aminophenol (paracetamol)

chemical → generic

also acetaminophen
is generic name
of panadol

Generic Name = official name

- Generic name is assign by the inventor for newer drugs
- It is uniform all over the world by an international agreement through WHO الاسم الرسمي
- Usually derived from chemical name
- Very short, name used for prescription تفقد عند كتابة الوصفة الطبية
- Example - paracetamol, aspirin, morphine, Amoxicillin, penicillin, codeine

Trade Name

اسم تطلقه الشركة المصنعة

- Name that is registered by the different manufacturer
- Followed by the trademark symbol® ←
- Can only be used by the manufacturer
- May have several trade names for single drug (depending on number of manufacturers) الدواء الواحد له أكثر من اسم مصنع
- Example- paracetamol (Panadol, Adol, fefadol)

CHEMICAL NAME	GENERIC NAME	TRADE/BRAND NAME
N-acetyl-para-aminophenol	Paracetamol	Panadol, Adol

Methods of Drug Classification Cont.

طريقة تصنيف الدواء

Drug can be classified based on

1. Chemical group المجموعة الكيميائية
2. Mechanism /site of action آلية العمل
3. Primary effect النتيجة الأولية

1- Classification based on chemical group Cont.

Drugs are classified based on their chemical structure compounds classified according to their chemical structures are useful for medicinal chemists. But it does not provide a meaningful classification scheme for categorizing drug effects.

Because:-

1- Only some compounds with similar chemical structures produce very similar biological effects

Example- morphine, heroin.

صنفي الأدوية التي تعود إلى تصنيف كيميائي مشترك نفس التأثيرات مختلفة

2. Most of the drugs belong to the same chemical class often produce much different effects

Example- apomorphine, nalorphine. → antidote to opioid.

3. Furthermore, compounds which differ in chemical structure often produce similar biological effects

Example- amphetamine, cocaine.

← استجابة

المركبات التي تختلف في التركيب الكيميائي نفس التأثير البيولوجي.

Classification based on chemical group Cont.

Some of the important classification based on chemical structure

- ✓ Alkaloids- opium(atropine, Morphine,)
- ✓ Glycosides-Digitoxin, Digoxin)
- ✓ Vitamins
- ✓ Barbiturates -CNS depressant
- ✓ Betalactam antibiotics-penicillin

Classification based on chemical group Cont.

2- Classification based on Mechanism/site of action:

- ✓ Most of the drugs are either agonist(stimulate the activity of receptors) or antagonist(block the activity of receptors)
- Beta blockers blocks -blocks the beta receptors-atenolol , metoprolol used in cardiac diseases
- ✓ CNS Stimulants -analeptics

Classification based on chemical group Cont

3- Drug classification based on Primary effect

- The table below shows drugs classification according to their primary pharmacological activity. تصنيف الدواء اعتماداً على لمشاطه الدوائى الأثرى

Drug Class	Primary Effects/ Approved Medicinal Uses	Examples
Opioids/Narcotic Analgesics →	Analgesia, sedation	morphine, codeine,
Antibiotics →	Bacterial infection control	Penicillin, tetracycline

General pharmacological principles

Pharmacology is divided into two key areas:-

تأثير الجسم على الدواء

1- pharmacokinetics (what the body does to the drug), it concerned with the processes that determine the concentration of drugs in body fluids and tissues over time, including drug absorption, distribution, metabolism, and excretion, **ADME**

2- pharmacodynamics (what the drug does to the body) the study of the method or mechanism of drug action on living tissues or the response of tissues to chemical agents at various sites in the body.

آلية عمل الدواء على النسيج الحي

Summary

➤ The development of pharmacology was made possible by important advances in chemistry and physiology that enabled scientists to isolate and synthesize pure chemical compounds (drugs) and to design methods for identifying and quantifying the physiologic actions of the compounds.

➤ All drugs (pure compounds) have a nonproprietary name (or generic name, such as a USAN designation) as well as a chemical name. Some drugs also have one or more proprietary names (trade names or brand names) under which they are marketed by their manufacturer. واحد واحد

➤ Drugs are classified based on their chemical structure compounds classified according to their chemical structures are useful for medicinal chemists

General pharmacological principles Cont.

1- **Pharmacokinetics** is divided into several areas including the extent and rate of absorption, distribution, metabolism and excretion, this is commonly referred to as the ADME scheme:

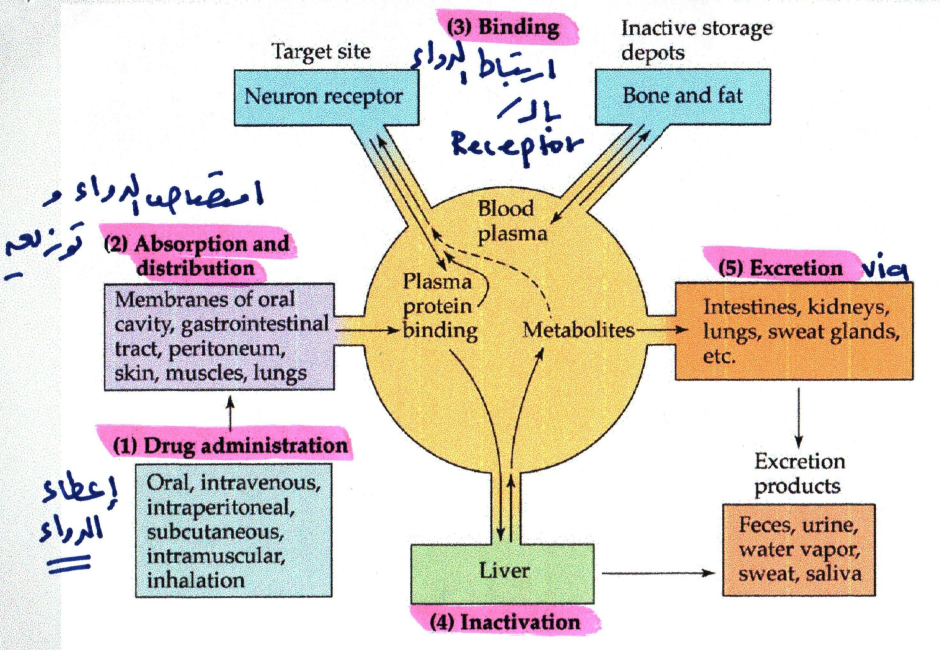
➤ **Absorption** - the process of a substance entering the blood circulation.

➤ **Distribution** - the diffusion of substances throughout the body fluids and tissues. انتشار المواد عبر السوائل والأنسجة

➤ **Metabolism** - the irreversible transformation of complex compounds into simple metabolites. تحويل لا رجعة منه من مركبات

➤ **Excretion (or Elimination)** - the elimination of the substances from the body. مفعلة إلى سيطر

Pharmacokinetics



PSYCHOPHARMACOLOGY, Figure 1.1 © 2005 Sinauer Associates, Inc.

General pharmacological principles Cont.

first-pass metabolism:- is a process of drug metabolism whereby the concentration of a drug is greatly reduced before it reaches the systemic circulation. It is the fraction of lost drug during the process of absorption which is generally related to the liver and gut wall.

Drug metabolism is the biochemical modification of drugs by living organisms, usually through specialized enzymatic systems.

نسبة الدواء المفقود خلال عملية الامتصاص
القدرية في كبد الأمعاء .

General pharmacological principles Cont.

Absorption and distribution

Bioavailability (BA): is a subcategory of absorption and is used to describe the fraction of an administered dose of unchanged drug that reaches the systemic circulation. when a medication is administered intravenously its bioavailability is 100%. However, when a medication is administered via other routes (such as orally), its bioavailability generally decreases (due to incomplete absorption and first-pass metabolism) or may vary from patient to patient.

oral → ↓ Bioavailability

General pharmacological principles Cont.

Drug excretion

Drugs are cleared primarily by the liver and kidneys. Excretion into the urine is a major route of elimination for metabolites and unchanged drug. Other routes of excretion are intestines, sweat glands and lungs

Half life of drug ($t_{1/2}$)

الوقت اللازم للتكثير إن يقل للنصف

This is the period of time required for the concentration or amount of drug in the body to be reduced by one-half.

The removal of a drug from the plasma is known as **drug clearance**

General pharmacological principles Cont.

2-Pharmacodynamics (what the drug does to the body)

It deals with the mechanism of action of a drug on the body which includes

- ✓> Drug-receptor interactions
- ✓> Dose-response phenomena
- ✓> Mechanisms of therapeutic and toxic action.

تأثير الدواء على الجسم

آلية عمل الدواء على الجسم

بدرجاته تفاعل مع الدواء لإحداث استجابة

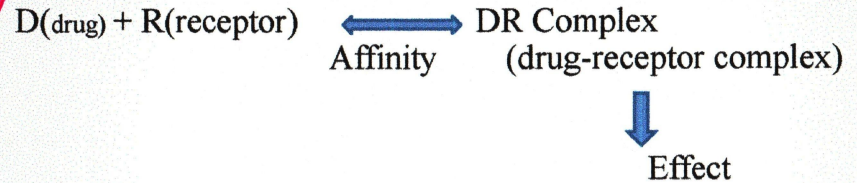
صياحي لطب الدواء للمحصل

فطالما الدواء .. قدرة الدواء على تغيير الجسم بطريقة تعطي تآثير

General pharmacological principles Cont.

➤ Drug-receptor interactions

Receptor :- A macromolecular component of a cell usually a protein in which a drug interacts to produce a response.



Affinity – measure of propensity of a drug to bind receptor; the attractiveness of drug and receptor

Efficacy (Effect) – ability of a bound drug to change the receptor in a way that produces an effect

General pharmacological principles Cont.

➤ Mechanisms of therapeutic and toxic action.

• To study the Process of drug actions and its clinical and toxic effects. Most of the drugs bind with receptor protein and act as agonist or antagonist

• **ED 50** - Median Effective Dose 50; the dose at which 50 percent of the population or sample manifests a given effect

• **TD 50** - Median Toxic Dose 50 - dose at which 50 percent of the population manifests a given toxic effect

• **LD 50** - Median Lethal Dose 50 - dose which kills 50 percent of the subjects

Therapeutic Index (TI) = $\frac{TD_{50} \text{ or } LD_{50}}{ED_{50}}$

↓
effective or therapeutic

الجرعة التي كمنها 50٪ من الناس يستفيدوا

الجرعة التي كمنها 50٪ من الناس تستفيدوا

الجرعة التي تبطل 50٪ من الناس

معلم

FIVE RIGHTS OF DRUG SAFETY

Taking and giving medications is an act that needs to be done carefully and taken quite seriously. All efforts need to be made to avoid errors. The radiographer must adhere to the five rights of drug administration at all times. They are as follows:-

- 1 ➤ The right Drug.
- 2 ➤ The right dose or amount.
- 3 ➤ The right patient.
- 4 ➤ The right time.
- 5 ➤ The right Route.

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FIVE RIGHTS OF DRUG SAFETY Cont.

Right Drug

✓ Administration of the wrong drug is the most common error that occurs.

Factors contribute to this error:

- 1) Similar labeling and packaging of products.
- 2) Similar names and storage of these similar products together.
- 3) Poor communication.

Precautions:

- Avoid using dosage and product abbreviations
- Never use trailing zeros (write 25 not 25.0)
- When in doubt, always check with the pharmacist or literature
- Do not administer any drug if you are unsure of its intended use for your patient
- Never assume ROUTE of administration

تجنب
الاقصاء

تجنب كتابة الصفر

لرؤية في البرية

اصحاب

الصيدلاني

اورشون الكتاب

لا تخن طريق إعطاء الدواء

لا تعطى الدواء

لرؤية من الدواء

FIVE RIGHTS OF DRUG SAFETY Cont.

Right Dose:

- How many times each day?
- How many tablets or doses are to be taken each day?
- How long does the patient need to continue to take the medication?
- It is important to consider the patient's age, size and vital signs when deciding if a dose is appropriate.
- Newborns, pediatric and elderly patients are particularly susceptible to slight changes in medication dose.

FIVE RIGHTS OF DRUG SAFETY Cont.

Right Patient

- Is this the patient's medication or is it for someone else?
- Confirm patient's identity prior to conducting any procedure.
- ❖ Check every patient's ID prior to giving a medication. Always confirm the patient's name, age and allergies, and ask the patient to state his name.

FIVE RIGHTS OF DRUG SAFETY Cont.

Right Time:

- What time of day should the medication be taken?
- What about food?
- Should it taken before a meal, with a meal, after a meal, or with a snack?
- Many hospitals have specific policies regarding the "before/after" rule; always check your facility guidelines.
- It is important to consider drug-drug and drug-food interactions. Many drugs interfere with absorption of other drugs when given simultaneously.

FIVE RIGHTS OF DRUG SAFETY Cont.

Right Route

This includes how to take the medication.

- Is it to be swallowed or chewed?
- Does it come in liquid form?
- Can it be crushed if necessary?
- If it's an injection ensure is it intramuscular or subcutaneous?
- Many medications can be administered by a variety of routes, such as oral, rectal, intravenous (IV), subcutaneous (SC), intramuscular (IM), or sublingual (SL).

The prescribed dosage is based on the route by which the drug is given.

Summary

عنا ١٣٠
نشير على الشروط والأعراض
لجاء إعطاء الدواء IV
لجاء إعطاء الدواء IV

- ✓ Pharmacology has two main subdivisions. Pharmacodynamics and pharmacokinetics.
- ✓ The tendency of a drug to bind to a receptor, called Affinity.
- ✓ The ratio of the median lethal dose (toxic dose) to the median effective dose (therapeutic dose) is called the therapeutic index, which is an indication of the margin of safety of a drug.
- ✓ Most drugs are excreted in the urine, either as the parent compound and/or as drug metabolites.
- ✓ The median effective dose (ED 50) produces 50% of the maximal response.

FIVE RIGHTS OF DRUG SAFETY Cont.

- In general, oral dosages are greater than injected dosages for the same drug.
- Errors can occur when a dose intended for oral administration is given by injection.
- E.g. 30 mg dose of Morphine Sulfate mistakenly given IV rather than orally could potentially result in respiratory arrest and death.

Caution for IV route:

- 1 ✓ Many drugs will cause severe soft tissue injury if the IV becomes infiltrated.
- 2 ✓ Check for blood return prior to administration of any IV medication given by direct IV injection (push), intermittent (IM) or continuous infusion (CI).
- 3 ✓ Medications given intravenously have a rapid onset of action.
- 4 ➤ It is necessary to stay with the patient during the first few minutes of any IV infusion to assess for signs and symptoms of adverse reaction.

Summary

- ✓ The five rights of drug administration are to be followed at all times.
- ✓ Age, disease, pregnancy, and lactation are factors that must be considered in drug selection and dosage.
- ✓ Each route of drug administration requires its own equipment and procedure
- ✓ take precautions to prevent adverse reactions, specially when you used IV drug administration because these drugs travel to the systemic circulation immediately.