INTRODUCTORY PHARMACOLOGY

(GNS 123)

UNIT – 1

TOPIC:

1.0 Terminologies and importance of Pharmacology

Instructional materials

Lectures

Visual (pictures & Charts)

Audio visuals (videos, DVD, internet, practical session)

Teaching methods

Group discussion

Demonstration

Presentation

Assessment

Written Assignment

SAQ/MCQ

Long Essay Questions

Learning Objectives

At the end of the lesson, the students should be able to

1.1 Define Terminologies in Pharmacology

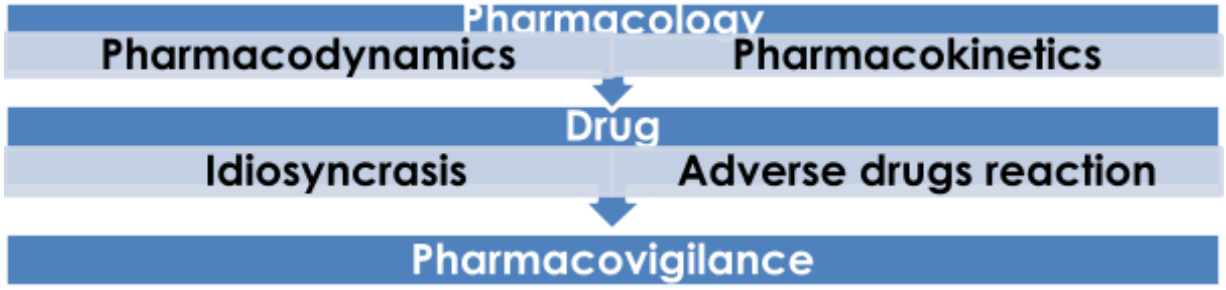
1.2 Discuss the importance of Pharmacology

1.3 Explain Chemical generic and brand names of drugs

Summary of contents

Introduction –

1.1 Define the following?



Pharmacology is the study of drug action. It involves looking at the interaction of chemical substances with the systems in our bodies, as well as identifying ways in which our biological systems affect drugs.

Is the science of drugs and their effect on living systems, you can find pharmacology present everywhere. In medicine cabinets, when you visit the dentists and when you take any type of medication. Pharmacology is also responsible for painkillers, caffeine drinks and antibiotics.

It is the science of what is happening to your body and to the drug itself.

Every medication we take alters the chemistry within our body. The role of

pharmacology is to understand why these changes are happening, allowing us to develop better drugs.

Pharmacology: The study of drugs and their interactions with living systems

Medical Pharmacology*:* The study of how drugs are used in diagnosis, prevention, and treatment of disease

Clinical Pharmacology: The study of drugs in humans (patient and volunteers)

Therapeutics: The medical use of drugs to diagnose, prevent and treat illnesses.

Pharmacology is crucial for:

Discovering new medicines to help fight diseases

Improving the effectiveness of medicines

Reducing unwanted side effects of medicines

Understanding why individuals differ in the way they respond to certain drugs, and why some others cause addiction.

Pharmacology lies at the heart of biomedical science, linking together chemistry, physiology and pathology. Pharmacologists work closely with a wide variety of other disciplines that make up modern biomedical science, including neuroscience, molecular and cell biology, immunology and cancer biology.

Pharmacological knowledge improves the lives of millions of people across the world. It maximizes their benefit and minimizes risk and harm

As new diseases emerge, and older medicines - like antibiotics - no longer work as well, the contribution of pharmacology to finding better and safer medicines becomes all the more vital.

Drug

Drug includes any substance or mixture of substances manufactured, sold or advertised for use in the diagnosis, treatment, mitigation or prevention of any disease disorder, abnormal physical state, or the symptoms there of, in man or in animals; restoring, correcting or modifying organic functions in man or in animals; disinfection, or the control of vermin, insects or pests; or contraception.

1. Drug: A substance intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease.

2. Drug: Any chemical that affects the physiologic & biochemical processes of a living organism.

3. Drug: Any substance that when taken into the body, may modify one or more of its functions (***Food, Drug, and Cosmetic Act)***

Major Uses for Drugs

1. ***Symptomatic:-***Relieve disease symptoms. Aspirin, Tylenol.

2. ***Preventative*: -**To avoid getting a disease, Hepatitis B.vaccine, Flu vaccine.
3. ***Diagnostic:-***Help determine disease presence. Radioactive dyes.
4. ***Curative: -***Eliminate the disease. Antibiotics.
5. ***Health Maintenance:-***Help keep the body functioning normally. Insulin.
6. ***Preventative***:-Contraceptive:

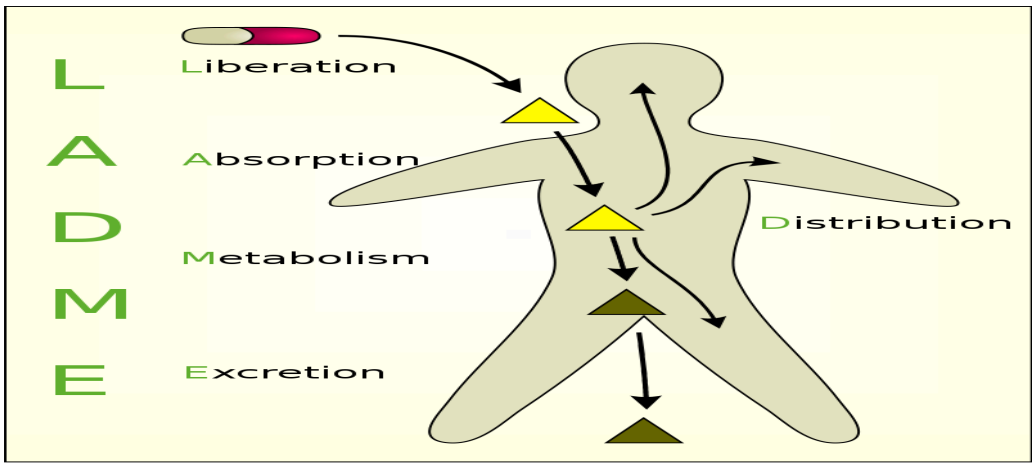
Pharmacokinetics (PK)

Pharmacokinetics is currently defined as the study of the time course of drug absorption, distribution, metabolism, and excretion. Clinical pharmacokinetics is the application of pharmacokinetic principles to the safe and effective therapeutic management of drugs in an individual patient. Primary goals of clinical pharmacokinetics include enhancing efficacy and decreasing toxicity of a patient's drug therapy. The development of strong correlations between drug concentrations and their pharmacologic responses has enabled clinicians to apply pharmacokinetic principles to actual patient situations. A drug's effect is often related to its concentration at the site of action, so it would be useful to monitor this concentration. Receptor sites of drugs are generally inaccessible to our observations or are widely distributed in the body, and therefore direct measurement of drug concentrations at these sites is not practical. For example, the receptor sites for digoxin are thought to be within the myocardium. Obviously we cannot directly sample drug concentration in this tissue. However, we can measure drug concentration in the blood or plasma, urine, saliva, and other easily sampled fluids.

Pharmacokinetics may be defined as the study of the dynamic movements of foreign chemicals (xenobiotics) during their passage through the body and as such encompass the kinetics of

absorption, distribution, biotransformation/metabolism and excretion (ADME). It can simply be described as how the body handles xenobiotics.

Pharmacokinetics



Most drugs exert their pharmacologic effects by binding to macromolecules known as receptors. Therefore, for a drug to produce a pharmacologic effect, it must be structurally capable of interacting with the appropriate receptor. However, the ability of a drug to interact with the receptor is not the only characteristic required for a therapeutically useful agent because it also must be capable of accumulating in the vicinity of the receptor site at a sufficient concentration. Pharmacokinetics is the aspects of pharmacology dealing with how drugs reach their site of action and are removed from the body. The following processes govern the rate of accumulation and removal of drug from an organism -absorption, distribution, metabolism, and excretion. Details of pharmacokinetics are provided as follows:-

1. Drug transport across membranes–For a drug to transfer to its site of action, mechanisms must be available to allow the drug to traverse numerous biological membranes. These include passive diffusion, filtration, active transport, and endocytosis. These mechanisms are also important for the transfer of endogenous substances required for life.

2. **Drug administration**–Drugs can enter the body from several sites, with the route of administration having a significant influence on the ability of a drug to accumulate at its site of action.

3**. Drug absorption**–Drugs can be absorbed into the circulation from numerous sites within the body.

4**. Drug distribution**–Once in the circulation, the drug is transferred to the interstitial fluid and to the cells of the body.

5. **Drug biotransformation–**There is an increased interest in the chemical changes in a drug once it enters the body. In most cases, these drug biotransformation reactions produce intermediates with less pharmacologic activity than the parent compound; however, some drug metabolites possess significant pharmacologic action. Furthermore, some metabolites are chemically reactive and capable of contributing to toxicity, mutagenesis, carcinogenesis, and birth defects.

6. **Drug excretion–**The primary sites for drug excretion are the liver and kidney, although the skin, lungs, and bile and intestine may be sites for excretion as well.

7. **Clinical pharmacokinetics**–Each of the above processes affect not only the rate of accumulation of a drug at its site action, but also its rate of removal. Clinical pharmacokinetics provides a quantitative description in humans of the behavior of drugs with different characteristics as well as the differences expected from different routes of drug administration

Pharmacodynamics (PD)

Is the branch of pharmacology concerned with the action of drugs on the body or on microorganisms within or on the body system, Pharmacodynamics described as what a drug does to the body, involves receptor binding, post receptor effects, and chemical interactions. Drug pharmacokinetics determines the onset, duration, and intensity of a drug's effect. Formulas relating these processes summarize the pharmacokinetic behavior of most drugs.

Pharmacodynamics is what a drug does in the body, and how the drug binds to receptors.

A drug's Pharmacodynamics can be affected by disorders that decrease the sensitivity of receptors in the body.

Pharmacodynamics is the branch of pharmacology concerned with the action of drugs on the body or on microorganisms within or on the body.

Idiosyncrasies (IS)

Idiosyncrasy in Pharmacology:-

In pharmacology, ***idiosyncrasy*** refers to an idiosyncratic reaction, which is an adverse effect to an agent, such as a drug, which does not occur in most patients who have used the same agent. That shouldn't be too surprising. In lay terms, when we say someone has a certain idiosyncrasy, we refer to a habit or mannerism that's peculiar to that person. So, an idiosyncratic reaction is an abnormal event, stemming from the use of a compound, which is peculiar (specific) to an individual.

Causes

To be clear, an idiosyncratic reaction is abnormal in nature and is therefore not possible to predict who may develop one, when, or what specific form it will take ahead of time. While the good news is that idiosyncratic reactions aren't all that common, the bad news is that when they do occur, many tend to be life-threatening in nature.

Why do idiosyncratic reactions occur? There is no single answer here. But it involves any combination of important factors like the person's genetic make-up, their immune system's response to the drug, and the chemical structure and other characteristics of the drug itself.

Examples: - Virtually any organ of your body can be affected by an idiosyncratic reaction. However, it's the skin, liver, and blood cells that are most

commonly affected. Some of the idiosyncratic reactions will target a specific organ while others can affect many organs at the same time. Again, how one plays out is difficult if not impossible, to predict ahead of time. If doctors knew you'd have one ahead of time, they wouldn't give you the drug in the first place!

The most common form of idiosyncratic reaction is a **skin** rash. This might be the case because the skin has a lot of immune system cells and molecules that can play a part in the development of an idiosyncratic reaction. Or it may be the case because even mild skin rashes are easily noticed and reported while mild idiosyncratic reactions affecting internal organs may go unnoticed. The type of skin rash could be something like hives, or it could even be a life-threatening 'rash' where the skin peels off the person.

Bottom of Form

Adverse Drug Reactions (ADR)

Adverse Reaction means a response to a medicinal product which is noxious and unintended and which occurs at doses normally used in man for the prophylaxis, diagnosis or therapy of disease or for the restoration, correction or modification of physiological function. A reaction, contrary to an event is characterized by the fact that a causal relationship between the drug and the occurrence is suspected, i.e. judged possible by the reporting or a reviewing health care professional.

A drug's desired effect is called the expected therapeutic response. An adverse drug reaction, on the other hand (also called a side effect or adverse effect), is a harmful, undesirable response.

Adverse drug reactions can range from mild reactions that disappear when the drug is stopped to debilitating diseases that become chronic. Adverse reactions can appear shortly after starting a new drug but may become less severe with time.

Adverse drug reactions can be classified as dose-related or patient sensitivity–related. Most adverse drug reactions result from the known pharmacologic effects of a drug and are typically dose- related. These types of reactions can be predicted in most case.

Dose-related reactions include:

- Secondary effects
- Hyper susceptibility
- Overdose
- Iatrogenic (iatrogenic) effects.

Secondary effects

A drug typically produces a major therapeutic effect as well as secondary effects that can be beneficial or adverse. For example, morphine used for pain control can lead to two undesirable secondary effects: constipation and respiratory depression. Diphenhydramine used as an antihistamine is accompanied by the secondary effect of sedation, which is why the drug is also sometimes used as a sleep aid.

Hyper susceptibility

A patient can be hyper susceptible to the pharmacologic actions of a drug. Even when given a usual therapeutic dose, a hyper susceptible patient can experience an excessive therapeutic response. Hyper susceptibility typically results from altered pharmacokinetics (absorption, metabolism, and excretion), which lead to higher-than-expected blood concentration levels. Increased receptor sensitivity can also increase the patient's response to therapeutic or adverse effects. Sedation is an example of a secondary effect.

Overdose

A toxic drug reaction can occur when an excessive dose is taken, either intentionally or accidentally. The result is an exaggerated response to the drug that can lead to transient changes or more serious reactions, such as respiratory depression, cardiovascular collapse, and even death. To avoid toxic reactions, chronically ill or elderly patients commonly receive low drug doses.

Iatrogenic effects

Some adverse drug reactions, known as iatrogenic effects, can mimic pathologic disorders. For example, such drugs as antineoplastics, aspirin, corticosteroids, and indomethacin commonly cause GI irritation and bleeding. Other examples of iatrogenic effects include induced asthma with propranolol and induced deafness with gentamicin.

Patient sensitivity–related adverse reactions

Patient sensitivity–related adverse reactions aren't as common as dose-related reactions. Sensitivity-related reactions result from a patient's unusual and

extreme sensitivity to a drug. These adverse reactions arise from a unique tissue response rather than from an exaggerated pharmacologic action. Extreme patient sensitivity can occur as a drug allergy or an idiosyncratic response.

Allergic reaction

A drug allergy occurs when a patient's immune system identifies a drug, a drug metabolite, or a drug contaminant as a dangerous foreign substance that must be neutralized or destroyed. Previous exposure to the drug or to one with similar chemical characteristics sensitizes the patient's immune system, and subsequent exposure causes an allergic reaction (hypersensitivity).

An allergic reaction not only directly injures cells and tissues, but also produces broader systemic damage by initiating cellular release of vasoactive and inflammatory substances. The allergic reaction can vary in intensity from a mild reaction with a rash and itching to an immediate, life- threatening anaphylactic reaction with circulatory collapse and swelling of the larynx and bronchioles.

Allergic reactions

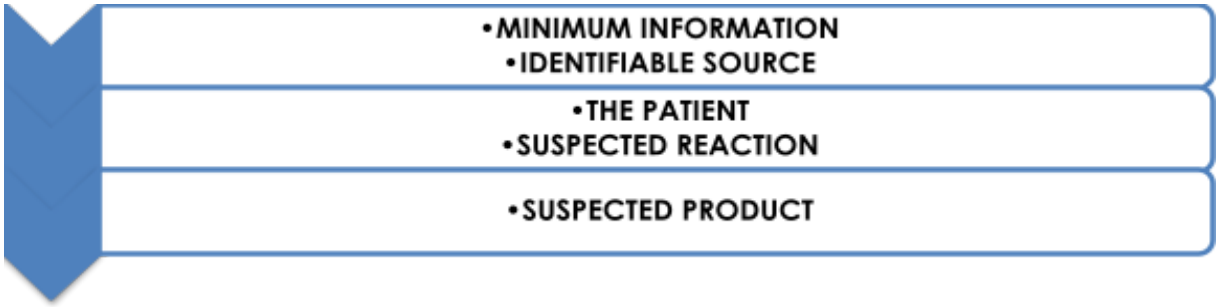
To drugs can range from a mild rash to life-threatening anaphylaxis. Get some help! Stat!

Idiosyncratic response

Some sensitivity-related adverse reactions don't result from the pharmacologic properties of a drug or from an allergy but are specific to the individual patient. These are called idiosyncratic responses. A patient's idiosyncratic response sometimes has a genetic cause.

Reporting Adverse Drug Reactions (R- ADR)

Points to Consider



Serious drug reaction:

Serious adverse reaction means an adverse reaction which results in death, is life -threatening, requires inpatient hospitalization, or prolongation of existing hospitalization, results in persistent or significant disability or incapacity, or is a congenital abnormality and or birth defect.

GUIDELINES TO FILL SERIOUS ADVERSE EVENT REPORT FORM

1. An adverse event is "Serious"
2. Is life threatening?
3. Results in permanent disability
4. Results in hospitalization

5. Is associated with death
6. Prolongation of hospitalization
7. Causes a birth defect
8. Causes malignancy
9. Causes a relevant organ toxicity
10. Is an overdose resulting in clinically?
11. Relevant signs and / or symptoms
12. An adverse drug event can be a manifestation of various etiologies such as Complication of an underlying disease
13. Intercurrent disease
14. Coincidental accident
15. Drug associated effect

ADVERSE DRUG REACTION REPORTING FORM

REPORT ON SUSPECTED SERIOUS ADVERSE DRUG REACTION

1. **DETAILS OF PATIENT**

Name of patient……..

Age…….. Weight (kg)……..Patient address…….....

Sex …… Race…….Pregnant **…. (**Yes)… (No)… (NA)…….

Relevant medical History …….....

2. **ADVERSE EVENT**

Reason for reporting ……

Requires or prolongs hospitalization Life threatening Death……

Permanently disabling or incapacitating …….....

Congenital abnormality ……

Drug Overdose ……

Others (Please Specify) ……

3. SUSPECTED DRUG

Name of suspected drug …….

Generic name ……..

Name of manufacturer ……

Date of occurrence duration of event …….

Starting date of medication ……

Route of administration ……..

Discontinuation of drug because of event... (No)... (Yes)...Dated……

……..

Rank/Designation Signature

PHC Facility ……..Date……..

Pharmcovigilance (PV)

According to World Health Organization - Pharmcovigilance is defined as the science and activities relating to the detection, assessment, understanding and prevention of adverse effects or any other drug-related problem. (WHO, 2004)

Why Pharmcovigilance?

To promote rational and safe use of medicines

To promote effective communication to the public

To promote education and clinical training

To improve community health practice

To improve public health and safety environment

To improve patient care and safety

To contribute to the assessment of benefit, harm, effectiveness and risk of medicines etc….

1.2 Importance of Pharmacology

- ✔ Understand drugs and how they can affect living things
- ✔ Know the right dosage of drugs and not just quantity
- ✔ Identify and respond to drug interactions, reactions and side effects and treat accordingly
- ✔ Know when to use drugs because some conditions do not need drug therapy

- ✔ Understand the process of drug intake, absorption, distribution, metabolism and elimination.
- ✔ Identify the properties of ideal drugs and otherwise
- ✔ Know the application of pharmacology in community heath practice with regards to the 5 right thus:-

1. **Use right drug**
2. **Give to right patient**
3. **Give right dose**
4. **Give by right route**
5. **Give at right time.**

- ✔ To know how drugs are absorbed, distributed, metabolized, and excreted well in patients.
- ✔ To know how drugs work and the effects that they bring and how patients respond to them.
- ✔ Maximise therapeutic benefit with minimum harm
- ✔ To teach the patients on how to take the drugs

Community Health Practitioners are expected to utilize their knowledge of pharmacology to;-

- ✔ Minimize medication errors that are made related to omission of one or more drugs and other pharmacologic agents.
- ✔ Supervise Junior Cadre in the administration of medications
- ✔ Develop a plan of care that includes pharmacologic agents.

- ✔ Recognize common uses and side effects of the client's medication
- ✔ Meet the Patients' learning needs.

1.3 Chemical, Generic and brand names of drugs

1) Chemical name

A name is derived from chemical composition and molecular structure

2) Generic name

Generic name assigned when drug was registered to come to the market.

3) Trade name

A name assigned by a manufacturer.

Example:-

Chemical: *N*-acetyl-*p*-amino-phenol

Generic Paracetamol (BP)

Acetaminophen (USP)

Trade : Panadol (500)

Tylenol (300)

Calpol

Students' Activity

Topic: Terminologies in Pharmacology

Learning outcome

Student should be able to:

1. Define the following terms

Pharmacology, Drug, Pharmacokinetics, Pharmacodynamics, Idiosyncrasies, adverse drug reaction and Pharmcovigilance

2. Discuss the importance of Pharmacology
3. Explain the chemical, generic and brand names of drugs

Task:

Student would line up in seven (7) groups, to define terminologies in pharmacology.

UNIT – 2

TOPIC: 2.1

Sources and Classification of drugs

Instructional materials

- Lectures
- Visual (pictures & Charts)

- Audio visuals (videos, DVD, internet, practical session)

Teaching methods

- Group discussion
- Demonstration
- Presentation

Assessment

- Written Assignment
- SAQ/MCQ
- Long Essay Questions

Learning Objectives

At the end of the lesson, the students should be able to:-

2.1 Discuss the six (6) sources of drugs

2.2 Describe Classification of drugs

2.2.1: Classification of drugs according to their functions

2.2.2: Classification of drug according to their forms

2.3 Explain Chemical generic and brand names of drugs

Summary of contents

Introduction –

2.1 Discuss the various Sources of Drugs?

Drugs are obtained from six (6) major sources:

1. Plant sources

2. Animal sources
3. Mineral/ Earth sources
4. Microbiological sources
5. Semi synthetic sources/ Synthetic sources
6. Recombinant DNA technology

Source	Example	Drug name	Classification
Plants 	cinchona bark purple foxglove	quinidine digitalis	antiarrhythmic cardiotonic
Minerals 	magnesium gold	Milk of Magnesia Solganal; auranofin	antacid, laxative anti-inflammatory used to treat rheumatoid arthritis
Animals 	pancreas of cow, hog thyroid gland of animals	insulin thyroid, USP	antidiabetic hormone hormone
Synthetic 	meperidine diphenoxylate	Demerol Lomotil	analgesic antidiarrheal

1. Plant Sources:

Plant source is the oldest source of drugs. Most of the drugs in ancient times were derived from plants. Almost all parts of the plants are used i.e. leaves, stem, bark, fruits and roots.

Leaves:

a. The leaves of Digitalis Purpurea are the source of Digitoxin and Digoxin, which are cardiac glycosides.

b. Leaves of Eucalyptus give oil of Eucalyptus, which is important component of cough syrup.

c. Tobacco leaves give nicotine.

d. Atropa belladonna gives atropine.

Flowers:

Poppy papaver somniferous gives morphine (opoid)

Vinca rosea gives vincristine and vinblastine

Rose gives rose water used as tonic.

Photo of Papaver somniferum by ***Evelyn Simak***

Fruits:

Senna pod gives anthracine, which is a purgative (used in constipation)

Calabar beans give physostigmine, which is cholinomimetic agent.

Seeds:

Seeds of Nux Vomica give strychnine, which is a CNS stimulant.

Castor oil seeds give castor oil.

Calabar beans give Physostigmine, which is a cholinomimetic drug.

Roots:

Ipecacuanha root gives Emetine, used to induce vomiting as in accidental poisoning. It also has amoebicidal properties.

Rauwolfia serpentina gives reserpine, a hypotensive agent.

Reserpine was used for hypertension treatment.

Bark:

Cinchona bark gives quinine and quinidine, which are antimalarial drugs. Quinidine also has antiarrythmic properties.

Atropa belladonna gives atropine, which is anticholinergic.

Hyoscyamus Niger gives Hyosine, which is also anticholinergic.

Stem:

Chondrodendron tomentosum gives tuboqurarine, which is skeletal muscle relaxant used in general anesthesia.

2. ***Animal Sources:***

- **Pancreas** is a source of Insulin, used in treatment of Diabetes.
- **Urine of pregnant women** gives human chorionic gonadotropin (HCG) used for the treatment of infertility.
- **Sheep thyroid** is a source of thyroxin, used in hypertension.
- **Cod liver** is used as a source of vitamin A and D.
- **Anterior pituitary** is a source of pituitary gonadotropin, used in treatment of infertility.
- **Blood of animals** is used in preparation of vaccines.
- **Stomach tissue** contains pepsin and trypsin, which are digestive juices used in treatment of peptic diseases in the past. Nowadays better drugs have replaced them.

3. ***Mineral Sources:***

i. Metallic and Non metallic sources:

- Iron is used in treatment of iron deficiency anemia.
- Mercurial salts are used in Syphilis.

- Zinc is used as zinc supplement. Zinc oxide paste is used in wounds and in eczema.
- Iodine is antiseptic. Iodine supplements are also used.
- Gold salts are used in the treatment of rheumatoid arthritis.

ii. Miscellaneous Sources:

- Fluorine has antiseptic properties.
- Borax has antiseptic properties as well.
- Selenium as selenium sulphide is used in anti dandruff shampoos.
- Petroleum is used in preparation of liquid paraffin.

4. Synthetic & Semi synthetic Sources:

i. *Synthetic Sources:*

When the nucleus of the drug from natural source as well as its chemical structure is altered, we call it synthetic.

Examples include Emetine Bismuth Iodide

ii. *Semi Synthetic Source:*

When the nucleus of drug obtained from natural source is retained but the chemical structure is altered, we call it semi-synthetic.

Examples include Apomorphine, Diacetyl morphine, Ethinyl Estradiol, Homatropine, Ampicillin and Methyl testosterone.

Most of the drugs used nowadays (such as antianxiety drugs, anti convulsants) are synthetic forms.

6. Microbiological Sources:

- Penicillium notatum is a fungus which gives penicillin.
- Actinobacteria gives Streptomycin.

- Amino glycosides such as gentamicin and tobramycin are obtained from streptomycis and micromonosporas.

7. Recombinant DNA technology:

Recombinant DNA technology involves cleavage of DNA by enzyme restriction endonucleases. The desired gene is coupled to rapidly replicating DNA (viral, bacterial or plasmid). The new genetic combination is inserted into the bacterial cultures which allow production of vast amount of genetic material.

Advantages:

Huge amounts of drugs can be produced.

Drug can be obtained in pure form.

It is less antigenic.

Disadvantages:

Well-equipped lab is required.

Highly trained staff is required.

It is a complex and complicated technique.

Classification of Drugs – (The 7 Types of Drugs)

1. Stimulants
2. Depressants
3. Hallucinogens
4. Dissociative
5. Opioids
6. Inhalants
7. Cannabis

Stimulants

Stimulants (or "uppers") impact the body's central nervous system (CNS), causing the user to feel as if they are "speeding up." These drugs increase the user's level of alertness, pumping up heart rate, blood pressure, breathing and blood glucose levels.

Doctors & other Community Health Practitioners primarily prescribe stimulants for ADHD, narcolepsy and asthma (because the drugs can open up breathing passages). The drugs can also help aid weight loss, as they can decrease appetite in users. Stimulant abuse occurs in high school when teens wish to enhance performance in school or sports.

Stimulants often come in pill form but are also consumed via snorting or even as food and drink. For example, caffeine is found in many beverages, and cocaine is a powder that is snorted.

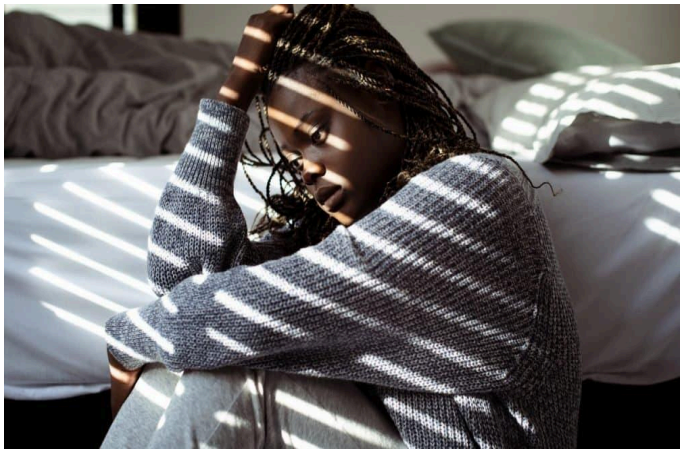
Examples of stimulants include:

a) Adderall, b) Ritalin, c) Synthetic d) Marijuana) e) Cocaine f) Methamphetamine, g) Ecstasy h) Caffeine

Risks of Stimulant Abuse

When abused, stimulants can cause a variety of undesirable consequences. These effects can include: **Anxiety, Paranoia, Psychosis, High body temperature, Depression, Heart failure, Stroke, Seizures**

Depressants



Like stimulants, depressants also impact the body's CNS, but with the opposite effect, making users feel as if things are "slowing down." Thus, they are often called "downers" on the street.

Doctors and other Community Health Practitioners prescribe some depressants for anxiety, insomnia, obsessive-compulsive disorder and other medical issues that prevent the sufferer from fully relaxing. These drugs often offer a sedative experience to users, making them a tempting choice for teens who wish to escape everyday stresses.

Examples of stimulants include:

- ✔ Rohypnol,
- ✔ Barbiturates,
- ✔ Xanax,
- ✔ Valium,
- ✔ Benzodiazepines

Alcohol as a Depressant

Alcohol acts as a depressant, making it a popular choice for users looking to relax. Although drinking is often associated with immediate bursts of energy after a sip, the user's vital functions inevitably slow down. Overdosing on alcohol can cause severe toxicity and even death.

Tobacco as a Depressant

The active ingredient in tobacco is nicotine, a chemical that acts as both a stimulant and a depressant. Tobacco gives users a minor, immediate rush, followed by a feeling of relaxation. Nicotine is one of the most addictive substances known to man, and is dangerous for your teen to even try.

Risks of Depressant Abuse

Depressants can be useful when used properly, but depressant abuse can cause a host of issues in both the long and short term:

- ✔ Higher risk of high blood sugar, diabetes and weight gain

- ✔ Increased body temperature
- ✔ Delirium
- ✔ Sluggish thinking
- ✔ Low blood pressure
- ✔ Impaired memory
- ✔ Hallucinations &Death from withdrawal.

Hallucinogens

Hallucinogens are diverse group of drugs that alters a person awareness of their surroundings. They are commonly split in to two (2) categories namely the classic hallucinogens LSD & Dissociative drugs PCP.

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- ✔ Low blood pressure

- ✔ Impaired memory
- ✔ Hallucinations
- ✔ Death from withdrawal

Risks of Hallucinogen Abuse

- Hallucinogen abuse can have devastating effects that can last a lifetime:
- Hallucinogen Persisting Perception Disorder, also known as flashbacks
- Fear
- Distorted cognition
- Paranoia
- Psychosis
- Anxiety
- Increased blood pressure
- Nausea

Dissociative

Dissociative distort the user's perception of reality, and cause users to "dissociate," or feel as if they are watching themselves from outside their own

bodies. They may gain a false sense of invincibility, and then engage in risky behavior such as driving under the influence or unsafe sex.

These drugs work by interfering with the brain's receptors for the chemical glutamate, which plays a significant role in cognition, emotionality and pain perception.Dissociatives can be taken as liquids, powders, solids or gases. The drugs include:

- Ketamine
- DXM (Dextromethorphan)
- PCP (phencyclidine)

Risks of Dissociative Abuse

Dissociative are very dangerous, especially when used over extended periods of time. However, their immediate impact can be quite distressing as well:

- Depression
- Anxiety
- Suicidal thoughts
- Speech difficulties
- Social withdrawal
- Hallucinations
- Detachment from reality
- Numbness
- Memory loss

Opioids

Opioids are powerful painkillers that produce a sense of euphoria in users. Derived from the poppy plant, Opioids are often prescribed by doctors to patients who are suffering from intense pain. They are extremely habit-forming, sometimes even causing addiction in as little as three days.

Opioids can be smoked, eaten, drank, injected or taken as pills. Examples of Opioids include: ***Heroin, Morphine, Hydrocodone, Opium, Vicodin, Oxycontin, Percocet, and Codeine***

Risks of Opioids Abuse

Opioids abuse can devastate the life of a user. Unfortunately, when someone decides to stop using Opioids, they suffer tremendously then, as well. For example, Hydrocodone withdrawal can be especially nasty, riddling sufferers with flu-like symptoms for weeks on end. Other effects include: ***Constipation, Liver damage, Brain impairment, Euphoria, Drowsiness, Sedation, Pupil dilation, Cardiac arrest (if dose is too high)***

Inhalants

Mostly made up of everyday household items, these drugs cause brief feelings of euphoria. As the name suggests, inhalants are always inhaled as gases or fumes. The "highs" slightly differ from inhalant to inhalant, but most abusers are willing to huff whatever inhalant they can acquire.

Examples of inhalants include:

- Fumes of markers, paint, paint thinner, gasoline and glue
- Nitrous oxide

- Aerosol sprays
- Room deodorizers

Risks of Inhalant Abuse

Inhalant abuse can have devastating effects, both immediate and in the long run:

- Loss of smell
- Brain damage
- Nosebleeds
- Weakness
- Euphoria
- Increased heart rate
- Loss of consciousness
- Hallucinations
- Slurred speech

Cannabis

Most commonly recognized as marijuana, cannabis acts like a hallucinogen, but also produces depressant-like effects. It is a Schedule I drug (i.e. it has a high potential for addiction) but has increasing medicinal uses in the United States. Still, marijuana is often abused by those who do not medically require it.

Cannabis can be smoked, vaporized, and even eaten, if the THC is first rendered from the plant matter.

Examples of cannabis include:

- Marijuana leaves
- Hashish
- Hash oil
- Cannabis-based medicines, such as Sativex.

Risks of Cannabis Abuse

Cannabis abuse can destroy lives and can have both short- and long-term impacts on users:

- Lowered immunity to illness
- Depression
- Chronic anxiety
- Reduced sperm count in men
- Sedation

- Slowed reaction times
- Enhanced senses, such as seeing brighter colors
- Impaired sense of time

The Purpose of Drug Classification

The aim of drug classification is to ensure that you use a drug safely to achieve the utmost benefit. Ultimately, every time you take a drug, your body chemistry is altered.

While this effect is meant to be therapeutic, it can also cause side effects that may be harmful. Moreover, if you take multiple drugs, your body chemistry may be changed in such a way that a drug is far less effective or the side effects are far more severe.

By noting the classification of a drug, you and your health care provider can have a better understanding of what to expect when you take it, what the risks are, and which drugs you can switch to if needed. This designation also helps identify drug-drug interactions and the potential for drug resistance and ensures the appropriate staging of treatment.

2.2.1 Classification of drugs according to their functions

- Analgesics, including Opioids and non-Opioids

- Anesthetics
- Antibacterial, including antibiotics
- Anticonvulsants
- Anti dementia agents
- Antidepressants
- Antidotes and antitoxins
- Antiemetic
- Antifungal
- Anti-inflammatory agents, including corticosteroids and nonsteroidal anti-inflammatory drugs (NSAIDs)
- Antimigraine agents
- Antimyasthenic agents
- Antimycobacterials
- Antineoplastics
- Antiparasitics
- Antiparkinson agents
- Antipsychotics
- Antiviral, including HIV antiretroviral and direct-acting hepatitis C drugs
- Anxiolytic (anti-anxiety) agents
- Bipolar agents
- Blood glucose regulators, including insulin and other diabetes medications
- Blood products, including anticoagulants
- Cardiovascular agents, including beta-blockers and ACE inhibitors
- Central nervous system agents, including amphetamines
- Dental and oral agents

- Dermatological (skin) agents
- Enzyme replacement agent
- Gastrointestinal agents, including H2 blockers and proton pump inhibitors
- Genitourinary (genital and urinary tract) agents
- Hormonal agents (adrenal)
- Hormonal agents (pituitary)
- Hormonal agents (prostaglandins)
- Hormonal agents (sex hormones), including estrogen, testosterone, and anabolic steroids.
- Hormonal agents (thyroid)
- Hormone suppressant (adrenal)
- Hormone suppressant (parathyroid)
- Hormone suppressant (pituitary)
- Hormone suppressant (sex hormones)
- Hormone suppressant (thyroid)
- Immunological agents, including vaccines and disease-modifying anti-rheumatic drugs (DMARDs)
- Inflammatory bowel disease agents
- Metabolic bone disease agents
- Ophthalmic (eye) agents
- Otic (ear) agents
- Respiratory tract agents, including antihistamines and bronchodilators
- Sedatives and hypnotics
- Skeletal muscle relaxants
- Therapeutic nutrients, minerals, and electrolytes

2.2.2 Classification of drugs according to their forms:

Forms of Drugs/Different Types of Dosage forms with examples"

Drugs are given in different forms. There are many forms of drugs to suit the needs of the individual patients.

A. Same drug is made in different forms for ease of administration, pharmacology and patient related factors.

For example, pain killers like diclofenac is available as tablet, injection and even ointment.
Tablets can be consumed voluntarily by the patient for its effect on whole of the body.

While injection form is given for unconscious patient and ointment is applied for local effect (like one portion of the body).

As such there a many forms of drugs for different purposes;

Forms of Drugs

Following a different drug formulation available;

1. Tablets
2. Capsules
3. Chewable tablets
4. Powders
5. Solutions
6. Emulsions
7. Suspensions

8. Lotions
9. Creams
10. Ointments
11. Effervescent granules
12. Aerosols
13. Gasses.
14. Suppositories
15. Injections

1. **Tablets:**

These are most common forms of drugs available in the market. They are economical, easy to handle and consume by the patient. They can be swallowed with a glass of water. They are of different shapes like circular, rectangular etc. They are also of different type like film coated, sugar coated ones etc.

2. **Capsule:**

HARD GELATIN CAPSULES

These are similar to tablets in the ease of administration. They have two gelatin shells in which active drug ingredients are packed. They are also quite popular like tablets but are comparatively expensive to make. The advantage is they can include liquid from of drug and also incompatible formulations in their shells.

3. Chewable tablets: These are similar to tablets in appearance but they are large in size with attractive color, odor and sweet taste. They are meant to be chewed in the mouth for the drug to release and show its effects. E.g.: Antacid tablets.

4. Powders: These are solid dosage forms and are in powder format. They are used for dusting and external applications like on wounds, cuts, skin infection etc.

5. Solutions:

These are very popular formulations. Here the drug is dissolved in a suitable solvent. Swallowing of fixed volume of liquid solution provides sufficient drug needed for cure by the body. These solutions are clear liquids but can have color, taste and also acceptable odor.

6. Nasal drops

These are commonly used for old age patients and children. The advantage is faster on set of action and also better absorption of drug in comparison to tablets.

E.g.: Oral syrups. Eye drops, Ear drops, Nasal drops etc.

7. Emulsions:

This is an interesting formulation where in water insoluble drug is made into liquid formulation by addition of soap like emulsifying agent. This emulsifying agent disperses the water insoluble drug as fine particles or goblets within the water by forming a film or cover around the drug particles. Read more on types of emulsions.

8. Suspensions:

These are liquid formulation but the difference is they have fine solid particles dispersed in an aqueous liquid. These formulations tend to form cream when kept undisturbed for long time. Hence they have a label "SHAKE WELL BEFORE USE." This helps the settled cream to disperse for uniform dosing of drug.

8. Ointments:

These are semi solid dosage forms. They can be solutions, suspensions or even emulsions but have high viscosity. They are intended for application on skin and other surface by spreading. They are easy to use and have an advantage of local effect to minimize adverse effects of drugs.

9. Effervescent granules:

They are also in the form of effervescent tablets. When put into water, they undergo chemical reaction to produce carbon dioxide gas. This when swallowed removes any gas from the stomach and helps in relieving gastric acidity.

10. Aerosols: These are powder or liquid formulations which are applied by spraying. The formulation is released as gaseous dispersion and so can reach deeper locations like respiratory tract.

11. Gasses:

Pure gasses like oxygen, carbon dioxide and nitrogen are also used as drug.

12. Suppositories:

These are solid dosage forms which are intended for insertion in the anus. They release drug slowly and good for local action

INJECTIONs - are mostly solution based formulations which are given to unconscious patient or in case emergency. The drug action by this method starts almost immediately.

Students' Activity

Topic: Classification of drugs

Learning outcome

Student should be able to:

1. Describe classification of drugs
2. Classify drugs according to their functions
3. Classify drugs according to their forms

Task:

Students would be paired in to three 3 groups to

1. Describe the purpose for drugs classification

2. Classify drugs by their functions

3. Classify drugs by their forms

UNIT 3

TOPIC:

Preparations and administration of drugs

Instructional materials

- Lectures
- Visual (pictures & Charts)
- Audio visuals (videos, DVD, internet, practical session)

Teaching methods

- Group discussion
- Demonstration
- Presentation
- Role Play

Assessment

- Written Assignment
- SAQ/MCQ
- Long Essay Questions

Learning Objectives

At the end of the lesson, the students should be able to:-

1. Explain reconstitution of drugs
2. Prepare diluted solutions of lotion from stock strength
3. Ex[plain the principles of drugs administration

Explain the reconstitution of drugs

Reconstitution is essentially the process through which you take a dry powdered drug and completely dissolve it using diluents. You add a specified volume of

diluents based on the formulation parameters to the dry powder, to give you your reconstituted preparation which has a specific concentration.

The drug solution and its preparation may be hazardous to the health of the clinician preparing it or to those within the environment and the necessary precautions must be taken to minimize risk. Drug errors can occur for many reasons but it has been suggested that many are caused by some those clinicians having poor mathematical skills (Trim, 2004).

Prepare diluted solutions of lotion from stock strength

PREPARATION OF DRUGS

Dilution of solution from stock

Dilution of lotion/solutions involves preparing a weaker solution from a stronger or concentrated stock solution; a community health practitioner may require to dilute lotions from one strength to another, when strength required is not available. The formula according to Houghton and Jee (1971) as well as Pamela (1979), is as shown below;

$$\frac{\text{Required strength} \times \text{Amount required in volume}}{\text{Stock strength}}$$

Example

Savlon is available in the clinic or ward and the health care provider/clinician need 300mls of 1:60 to disinfect a rubber catheter. What amount of required strength will she take from the stock strength to which water will be added in order to get the required amount?

Solution

- Determine your givens:
- Stock strength = 1:20
- Required strength = 1:60
- Amount required = 300ml

Therefore,

$$\frac{1:60}{1:20} \times \frac{300}{1}$$

$$= \frac{11}{60} \times \frac{300}{20 \div 1}$$

= 100mls (Required strength)

Calculation of drug dosages

This is one of the most important aspects of pharmacology. Different drugs were found to have several dosages as such, these attract pharmacologist to have a good focus for the purpose of dosage adjustment in line with the paediatric dosage, weight variations among others. The methods covers individual of all ages.

a) Children dosage calculation

Fried Man's Rule – This drug calculation is dealing with the children less than one year of age. Therefore, the formula reads as follows:

$$\frac{\text{Adult dose x Age of a child in months}}{}$$

150

Example – What dose of paluther injection you will give to a child of 10 months when the adult dose is 2ml?

Solution: 2ml x 10

150 = 20ml

150 Answer = 0.13.

a. Young's Rule – This dosage calculation is limited to children from 1-12 years of age.

Formular is Age of child in years x adult dose

Age of the child+121

Example How many mg of paracetamol will you give to a child of 8 years when the adult dose is 1000mg?

Solution - 8 x 1000mg Ans = 400mg.

8+12 1

b. Clarke's Rule – This is also dealing with the children but weight of them is usually the central focus rather than the age of the child.

Formular is **Weight of child in pounds** x **Adult dose**

1501

Example what dose of metronidazole will you give to a child of 40 pounds (20 pounds = 1Lb) when the adult dose is 400mg?

Solution 40 x 400mg Ans = **106.6** approx. **=107**mg. 1501

Calculation of drugs Using Simple Proportion

The dosage calculations are required when the amount of medication ordered or desired is different from what is available on hand for the clinician to administer; therefore, it involves calculation of required drug dosage from the whole drug.

Formula is **Amount DESIRED (D)** X **QUANTITY** (**Q**) **=Y (Tablets Required)**

Amount on HAND (H)

Note: when medication is given in tablet, the **QUANTITY** = **1** since the amount of medication available is specified per **(one)** tablet.

Example Nitrofurontoin Na, 50mg is ordered. Nitrofurontoin Na is available as 100mg per tablet. How many tablets will the clinician administer?

Solution - **Step 1**: Amount required/Desired (D) = 50mg

Amount on hand (H) = 100mg tablet

Quantity (Q) = 1

Step 2: Plug in what you know into formula and simplify

D X 1

H

50mg x 1 Ans = 0.5mg.

100mg

Note: The same formula is applied where the medication is in volume, for example Frusemide is available as 20mg in 1ml. 10mg is ordered to be administered through IV. What amount should the clinician administer?

Solution = 10mg/20mg x 1ml = Ans 0.5ml.

DOSAGE CALCULATION BASED ON BODY WEIGHT

This dosage calculation is usually done in two main stages

Stage 1: weight (kg) x Dosage ordered = Y (Required Dosage)

Stage 2: Apply the **D x Q**

H

Explain the principles of drugs administration

All drugs can be administered via a number of routes, and many can be administered by more than one.

Bolus: Is the administration of a medication, drug or other compound that is given to raise its concentration in blood to an effective level. The administration can be given intravenously, by intramuscular, intrathecal or subcutaneous injection.

Inhaled: (breathed into the lungs), as an aerosol or dry powder. (This includes smoking a substance).

Injection asa solution, suspension or emulsion either: intramuscular, intravenous, i ntraperitoneal, and intraosseous.

Insufflations: or snorted into the nose.

Orally: as a liquid or solid, that is absorbed through the intestines.

Rectally: as a suppository, that is absorbed by the rectum or colon.

Sublingually: diffusing into the blood through tissues under the tongue.

Topically: usually as a cream or ointment. A drug administered in this manner may be given to act locally or systemically.

Vaginally: as a pessary, primarily to treat vaginal infections.

Routes of Administration

Oral

- **Given by mouth and swallowed**

a) Easiest and safest method

b) Most economical method

Disadvantage

a) Slow method of absorption

b) Possibility of being destroyed by gastric juices

Sublingual

Placed under the tongue – dissolves in saliva

Advantage

a) More rapid absorption rate than oral

b) Higher concentration of medication reaches bloodstream

Disadvantage

a) Not convenient route of administration for bad-tasting medications or irritating medications

Buccal

Placed in mouth next to cheek (tablet form)

Advantage

a) More rapid absorption rate than oral

b) Higher concentration of medication reaches bloodstream

Disadvantage

Possibility of swallowing the pill

Inhalation

a) Medication is sprayed or inhaled into nose, throat, and lungs

Advantage

a) Good absorption due to large surface contact area

b) Provides rapid treatment

Disadvantage

a) Sometimes difficult to regulate dose

b) Not suitable method for medications that irritate mucous membrane lining

Rectal

a) Medication inserted into rectum and is slowly absorbed into mucous membrane lining of rectum (suppository)

Advantage

a) One method of choice when patient is nauseated or cannot take medications orally

Disadvantage

a) Absorption is slow and irregular

Vaginal

a) Medication is inserted into the vagina in the form of a suppository, cream, foam, or tablet

Advantage

a) Easiest method for treating the specific area

Disadvantage

a) Medications sometimes stain underwear

b) No other disadvantages

Topical

a) Medication is applied directly to the skin or mucous membrane for a local effect to area

Advantage

a) Easy method, convenient

Disadvantage

a) Slow absorption through skin

Transdermal

a) Method of applying a pre-measured amount of medicine to unbroken skin through an adhesive-backed disk

Advantage

a) Good method for administering medications slowly into bloodstream over a period of time

Disadvantage

Units can be dangerous if they come in contact with skin of children or pets

Parenteral

a) Administered by injecting medication into body using a needle and syringe

b) Must be in liquid form

Administered by one of following methods

1. ***Intradermal***
2. ***Intramuscular***
3. ***Intravenous***
4. ***Subcutaneous***
5. ***Intradermal***

a) Small amount of medication is injected just beneath epidermis

b) Used for allergy testing, tuberculin skin testing, and some vaccinations

i. **Needle Angle: 10 to 15-degree**

Intramuscular

b) Medication is injected directly into muscle

c) Used for administering antibiotics, medications that might be irritating to layers of the skin, and medications that require dosages larger than amount allowed for subcutaneous injections

ii. **Needle Angle: 90-degree**

Intravenous

a) Medication is injected directly into the vein, entering the bloodstream immediately

b) Used when medication is needed quickly

c) Used for infusing medication over a period of time, by adding the medication to a bag of intravenous fluids.

iii. Needle Angle: 25-degree

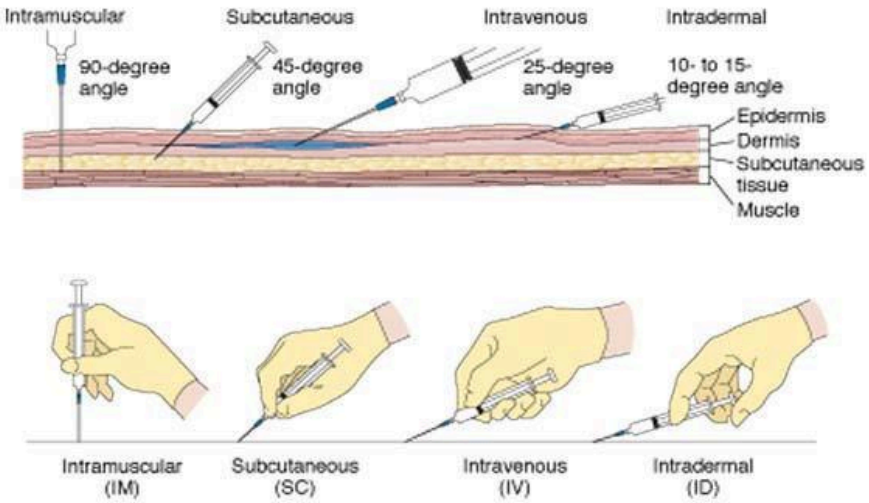
Subcutaneous

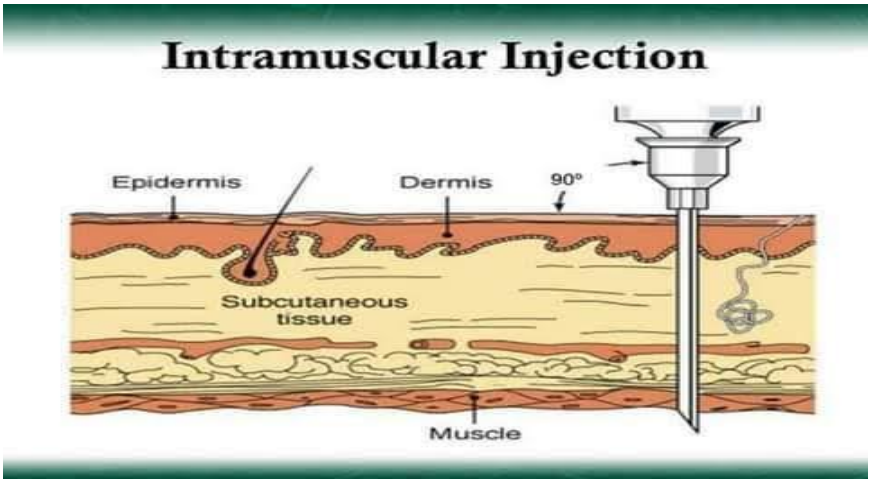
a) Medication is injected into subcutaneous layer, or fatty tissue of skin

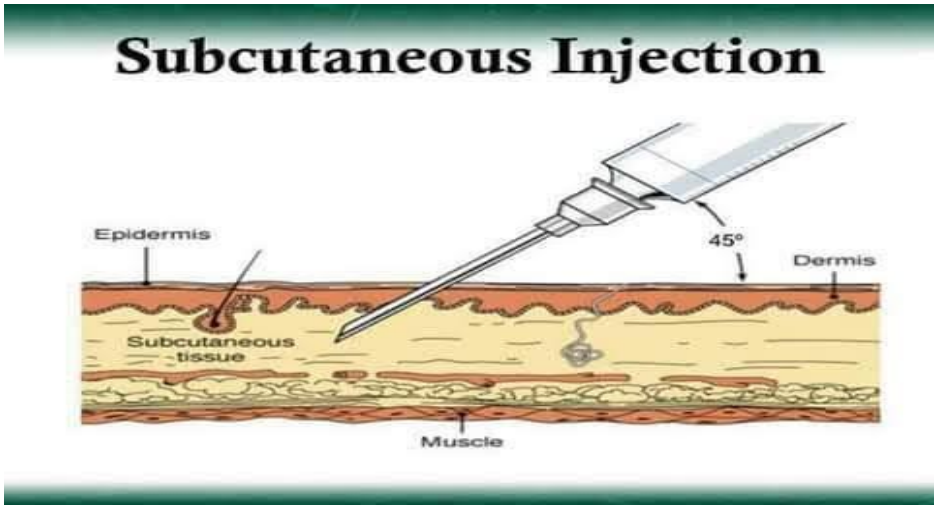
b) Used for administering insulin, hormones, and local anesthetics

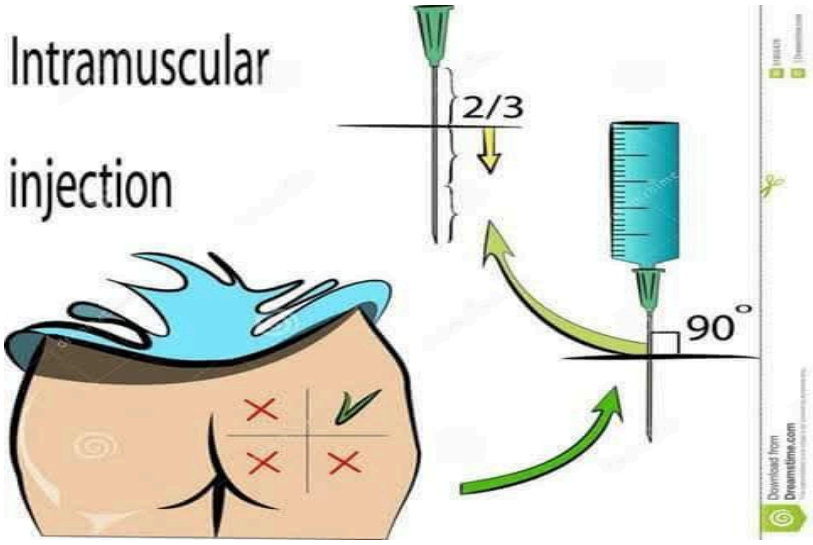
iv. Needle Angle: 45-degree

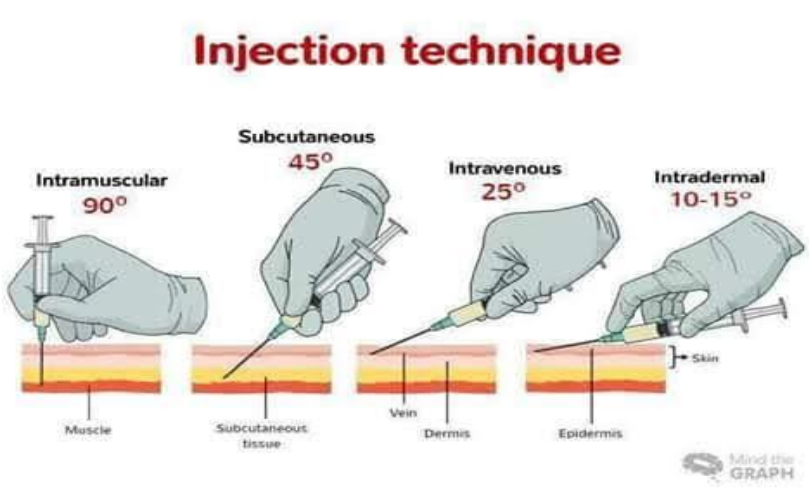
Parenteral Routes of Administration


Intramuscular
Subcutaneous
Intravenous
Intradermal
90-degree angle
45-degree angle
25-degree angle
10- to 15-degree angle
Epidermis
Dermis
Subcutaneous tissue
Muscle
Intramuscular (IM)
Subcutaneous (SC)
Intravenous (IV)
Intradermal (ID)

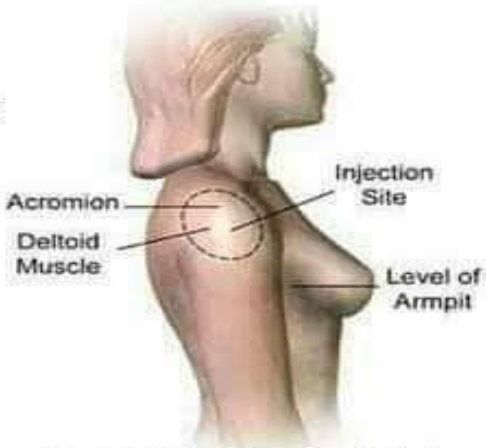

Intramuscular Injection
Epidermis
Dermis
90°
Subcutaneous tissue
Muscle


Subcutaneous Injection
Epidermis
45°
Dermis
Subcutaneous tissue
Muscle


Intramuscular
injection
2/3
90°
Download from
Dreamstime.com

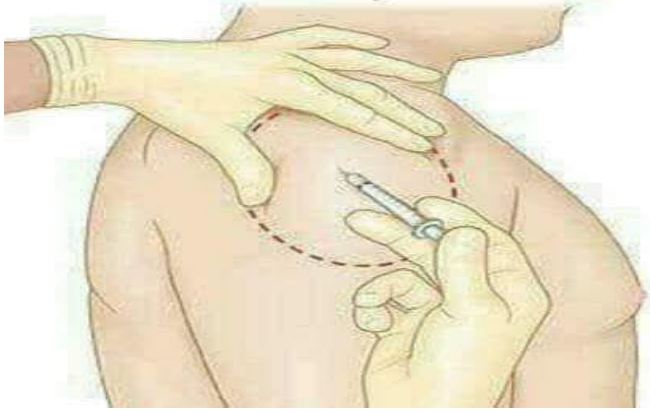

Injection technique
Intramuscular
90°
Subcutaneous
45°
Intravenous
25°
Intradermal
10-15°
Skin
Muscle
Subcutaneous tissue
Vein
Dermis
Epidermis
Mind the GRAPH

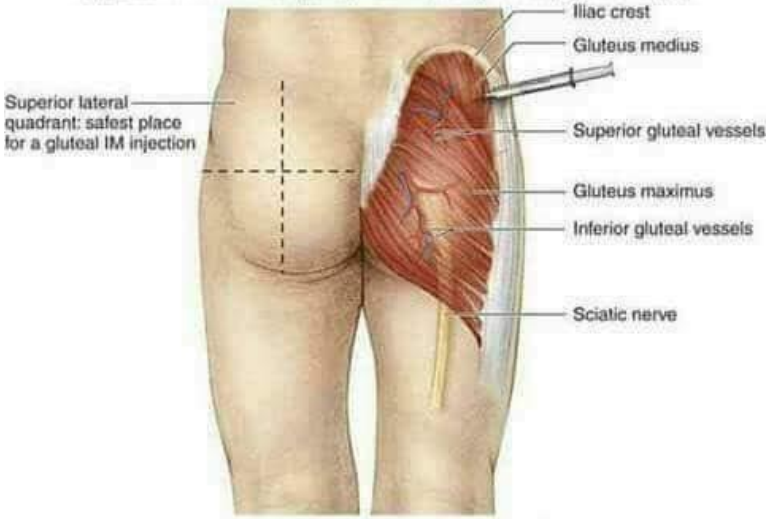
Correct Place
to Give Shot in the Rear-End



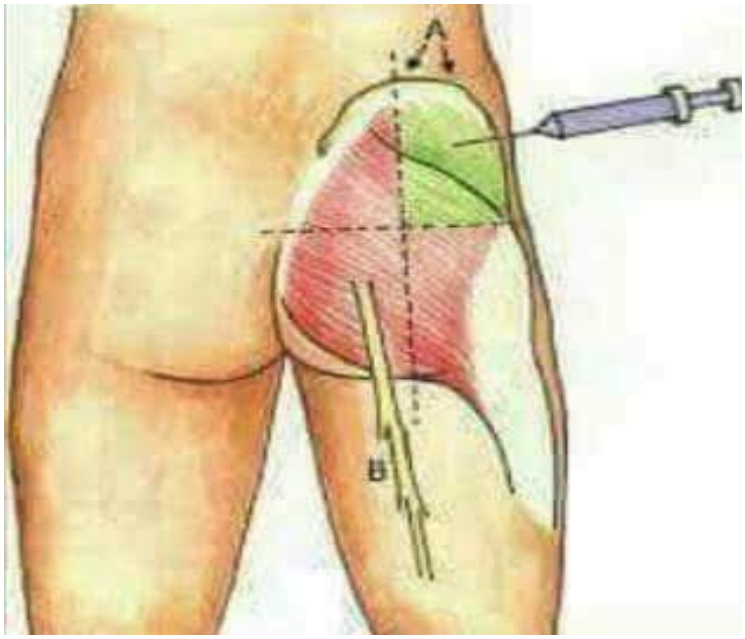
Correct Place to Give Shot
in the Deltoid Muscle

Deltoid Injection





Proper placement of a gluteal intramuscular injection



Students' Activity

Topic: Preparation and administration of drugs

Learning outcome

Student should be able to:

1. Explain reconstitution of drugs
2. Prepare diluted solutions of lotion from stock strength
3. Ex[plain the principles of drugs administration

Task:

Student would be divided in 3 groups to;

1) Demonstrate drugs reconstitutions,

2) Demonstrate how to prepare diluted lotion from stock

3) Explain the principles of drug administration