

## **Nursing -Level III**

**Based on January, 2022, Curriculum Version I**



**Module Title: MEDICATION AND MONITORING**

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Abbreviation	Intended meaning
BID	"twice a day"
IM	Intramuscular
IV	Intravenous
PO (PER OS)	"by mouth"
SC	Subcutaneous

## Introduction to Medication and Medication Monitoring

A crucial element of the **role** of nurses in health care setting across the world is to correctly calculate doses and safely administer **medication** to patients. To ensure patient safety, it is essential the correct procedure is implemented so the correct medicine is given in the prescribed amount using the most appropriate route. Medication administration requires good decision-making skills and clinical judgment, and the nurse is responsible for ensuring full understanding of medication. Since medication administration is one of the vital roll and responsibilities of the nurse, and also the main element of patient care adequate knowledge, attitude and skill are required to administer drug safely and to manage any problems that may occur during implementation; This module aims to equip the trainee with the knowledge, skills and attitude required of enrolled nurses to administer, monitor and evaluate medications and their effectiveness for clients within a heath environment

## MODULE UNITS

1. Pharmacology in the nursing
2. Safe Medication administration
3. Medication Preparation
4. Medications administration
5. Monitoring and evaluating client response to administered medication

### **LEARNING OBJECTIVES:**

At the end of this session, the trainee will be able to:

- Apply pharmacology in the field of nursing practice.
- Minimize potential risk during medication
- Prepare medication
- Perform medications administration
- Monitor and evaluate client response to medication

## Unit One: pharmacology in nursing

### Instruction sheet

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- Basic concept of pharmacology
- Pharmacodynamics
- Pharmacokinetics
- Classification of drugs
- Adverse reactions of drug
- Pharmaceutical dosage forms and system of measurement
- Dosage calculations
- Drugs standards and nursing management
- Drugs affecting the gastrointestinal system
- Anti - inflammatory drugs
- Drugs act on respiratory system
- Drugs act on cardiovascular system
- Drugs act on the renal system
- Drugs act on endocrine system
- Drugs act on the nervous system
- Drugs act on the musculoskeletal system
- Drug that act on integumentary system
- Drug that act on EENT system
- Chemotherapy of infectious diseases
- Cancer chemotherapy
- Pregnancy drug category and classification
- Describing fluids and minerals
- Essential drugs list in Ethiopia



This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Describe action and interaction
- Explain pharmacodynamics and pharmacokinetics
- Explain classification of drug
- List drug s acting on different organ
- Identify essential drugs in Ethiopia
- Calculate drug dose

### **Learning Instructions:**

1. Read the specific objectives of this Learning Guide
2. Follow the instructions described below 3 to 6
3. Read the information written in the information —Sheet 1, Sheet 2, and Sheet 3
4. Accomplish the —Self-check 1, Self-check t 2, and Self-check 3.
5. If you earned a satisfactory evaluation from the —Self-check proceed to — Unit Two

## **1.1 Basic concept of Nursing pharmacology**

### **Introduction**

Pharmacology is the study of medicines and is a discipline devoted to patient therapy through the use of drugs. In other words it is a discipline devoted to patient therapy by the use of drugs. The science or study of drugs: their origin, preparations, properties, uses, actions and effects. As such it includes indications, contra-indications, selective activity (activity whereby a drug acts on a particular part of the body at a time for treatment. is the study of drugs (chemicals) and their interactions with the body. The term is derived from the Greek pharmakon which can mean both ‘remedy’ and ‘poison’. In modern medical practice we use drugs more and more to treat and manage disease, so it is vital that as nurses we understand the basic mechanisms of drug action. It is the science of drugs in a broad sense, it deals with interaction of exogenously administered chemical molecules (drugs) with living systems. It encompasses

all aspects of knowledge about drugs, but most importantly those that are relevant to effective and safe use for medicinal purposes

## Definition of basic terms

**Pharmacy:** This is the art and/or science of preparing and dispensing drugs used for the prevention, diagnosis and treatment of diseases. It is also a shop/place for selling or compounding and dispensing drugs

**Drug:** A chemical substance, which has a selective activity or value in the treatment of a disease or can affect living things/processes. In other words they are, biologically active compounds given to humans or animals with the intention of changing the state of body functioning: to relieve pain, treat conditions, eliminate infection or improve health in any way or to investigate the functions of the body.

**Clinical Pharmacology:** study of drugs in humans

**Therapeutics:** use of drugs to diagnose, prevent and treat illness

Application of drugs in the prevention, diagnosis and treatment of a disease(s) or to alter a normal body function (e.g. oral contraceptive). The area is at the core of the nursing profession especially for maintaining health and sometimes longevity. The main objective of therapeutics is to provide maximum benefit of the drug and minimum harm to the organism. Pharmacokinetics: it is the study of the time-course of absorption, distribution, metabolism and excretion of drugs in the body. Pharmacodynamics: is the study of the actions and effects of drugs in the biological system

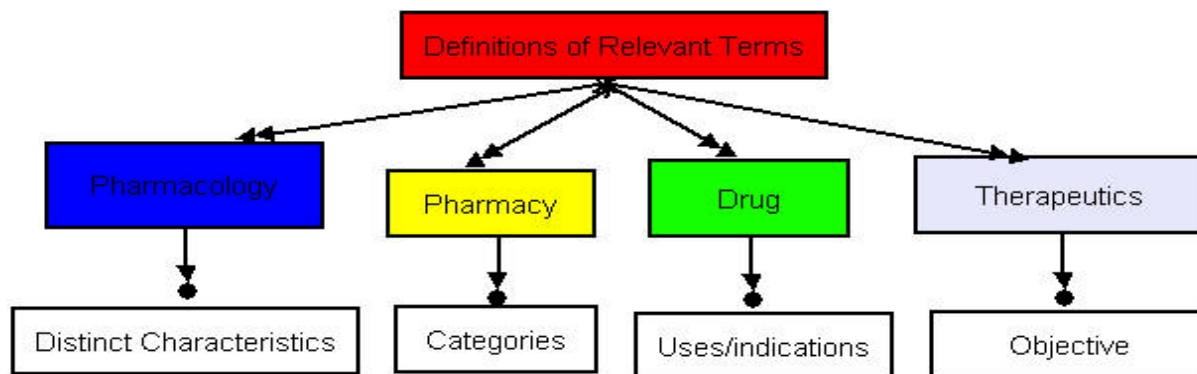


Figure : 1 relevant terms

## Properties of Ideal Drug

**Effectiveness:** A drug that elicits the response it was meant to (FDA approved with appropriate experiments)

**Safety:** Safe even at high concentrations and for long periods of administration (no such thing)  
Reduced by proper administration (iv, ip, im, sc, etc...)

No habit forming aspects

No side effects (resp. failure, immune reaction, etc...)

Selectivity: – Selective for specific reaction with no side effects

e.g. Cramps, fever, nausea, depression, anemia, etc...

Additional Properties of Ideal Drug (no drug is ideal!)

Reversible action- removal w/i specific time (1/2 life is short but potent during that time)

Predictability- know how patient will respond

Ease of Administration- number of doses low and easy to administer (inc. compliance & decrease errors)

Freedom from drug interactions- should not augment or decrease action of other drugs or have adverse combined effects

Low Cost- easy to afford (especially with chronic illness)

Chemical Stability- no lose of effectiveness with storage

Possession of a simple generic name- easy to remember and pronounce

Drug name: the name of the drug may be generic, trade or chemical name.

Drug family: which indicates the drug's chemical derivation e.g. steroids, xanthenes.

Mechanism of action: explains how a drug produces an effect on body cells or tissues.

Side effects: which are desirable or undesirable physiologic effects exerted by the drug other than the intended therapeutic effect.

Adverse reactions: which are undesirable effects apparent in the recipient e.g. toxic, teratogenic effects and etc.

Drug interactions: effects caused by the simultaneous use of a drug and other chemical that are not seen with the drug alone.

Precautions: measures taken to prevent or reduce adverse effects.

Contraindications: conditions or symptoms that alert the health care practitioner to the potential dangers of the drug.

Therapeutic Objective of drug

To provide maximum benefit with minimum harm

Factors that determine Intensity of Response

Administration- dosage size and route (because of errors in administration routes and dosage and at wrong time there are many discrepancies in what patient gets and could cause more harm than good)

## 1.2 Pharmacodynamics

General Pharmacology consists of two fields of interest, pharmacodynamics pharmacokinetics.

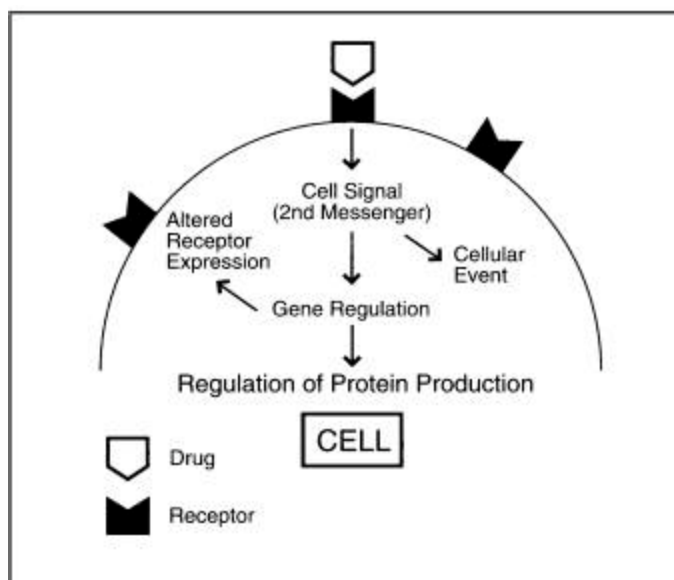
The most important concept in pharmacodynamics is the dose-response relationship, which describes the dependence of the effect of a drug from its concentration at its receptor.

Main topics in pharmacokinetics are the distribution of drugs in the various compartments of the body and the time course of their concentration in the blood.

### Pharmacodynamics

**Pharmacodynamics** is defined as the study of the biochemical and physiological effects of drugs and the molecular mechanisms by which these effects are produced. It is the process by which drug influence cell physiology. Some drug act by destroying or inhibiting the growth of microorganism other may protect cells from the **influence of physical or chemical agents**. Relationship between drug concentration at the site of action and the resulting effect, including the time course and intensity of therapeutic and adverse effects. The effect of a drug present at the site of action is determined by that drug's binding with a receptor. Receptors may be present on neurons in the central nervous system (i.e., opiate receptors) to depress pain sensation, on cardiac muscle to affect the intensity of contraction, or even within bacteria to disrupt maintenance of the bacterial cell wall. For most drugs, the concentration at the site of the receptor determines the intensity of a drug's effect. Other factors affect drug response as well.

Density of receptors on the cell surface, the mechanism by which a signal is transmitted into the cell by second messengers (substances within the cell), or regulatory factors that control gene translation and protein production may influence drug effect



**Figure 2:** Relationship of drug concentration to drug effect at the receptor site.

### 1.3 Pharmacokinetics

- Pharmacokinetics= (drug/poison)+(motion)
- Study of drug movement throughout the body
  - ✓ drug metabolism
  - ✓ drug excretion

**Pharmacokinetics** is the study of the way in which drugs move through the body during absorption, distribution, metabolism and excretion concerned with the effect of a drug at its site of action, the dose-response relationship of the drug, and the influence of other factors on the drug effect!

- Drugs interact with the body to produce their effects.,.
- Once a drug has reached its site of action, pharmacodynamic processes determine the type of response and intensity

Each patient is unique in ability to respond and to how they each respond, but formation of “IDEAL DRUG” will lessen this variation

- Age-very important factor
- Sex-due to hormonal differences
- Weight- less effective and longer lasting in obese individuals (storage in fat)
- Kidney & liver functions - elimination of drug
- Genetic variables- tolerance, allergy (though not always genetic)

#### Four pharmacokinetic processes

- Absorption- movement from site of administration into blood
- Distribution- movement from blood to interstitial space of tissue and then into cells
- Metabolism- enzymatic alteration of drug structure
- Excretion- movement of drug and metabolites out of body
- All of these determine the effective concentration of drug at it site of action
- Pharmacokinetics impudence route choice and occur after administration

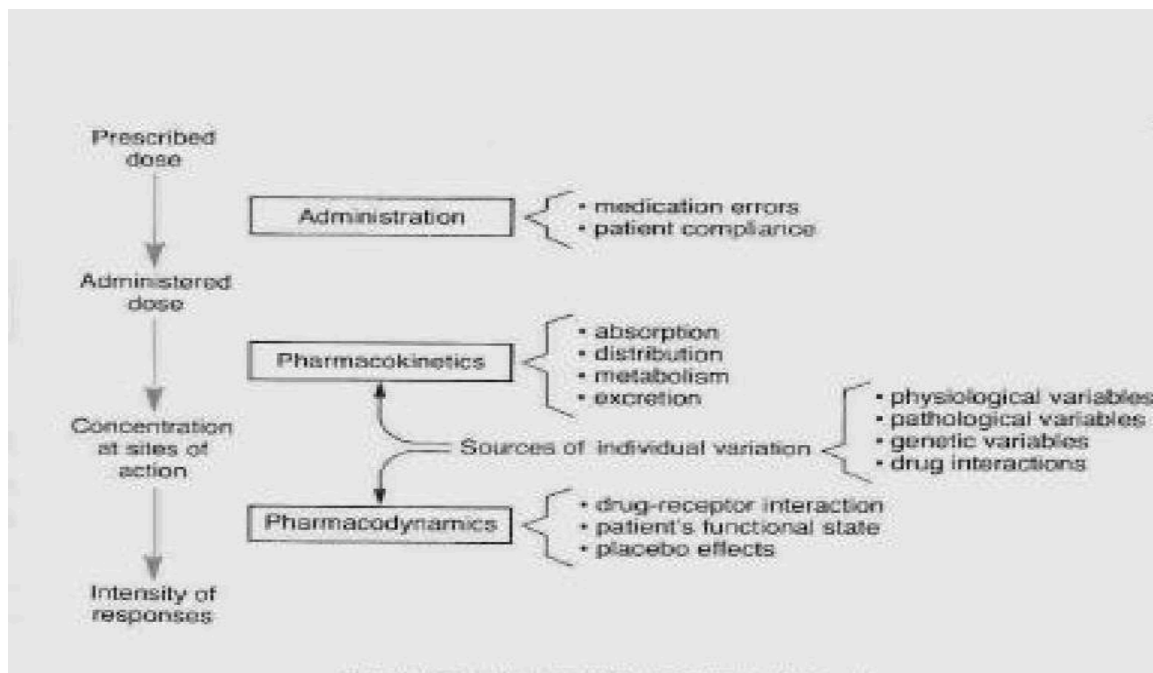
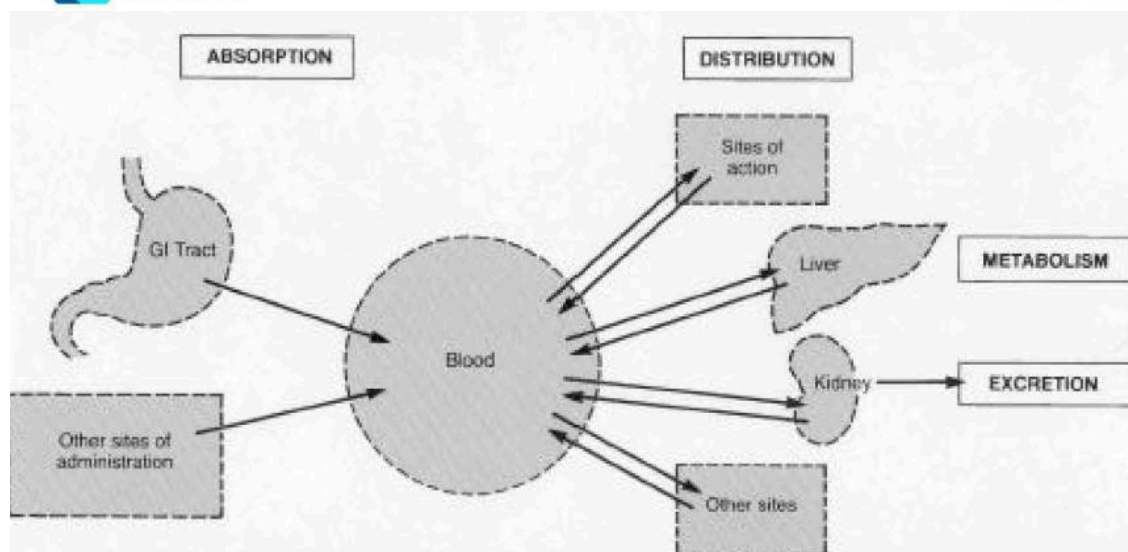


Figure 3: Pharmacodynamics & pharmacokinetics process



**Figure 4. drug absorption and distribution process**

## Absorption

Absorption is the process by which the drug enters in to the systemic circulation from the site of administration through biological barriers.

In case of intravenous or intra-arterial administration the drug bypasses absorption process and it enters into the circulation directly.

Mechanisms of Absorption

### Passive Transport

**Simple diffusion:** movement of a substance(drug) through a biological barrier from the phase of higher concentration to phase of lower concentration

e.g highly lipid soluble drugs

**Filtration:** The process by which water soluble drugs of relatively low molecular weigh crosses the plasma membrane through pores as a result of hydrodynamic pressure gradient a cross the membrane eg urea.

## Specialized Transport

Facilitated diffusion (carrier mediated diffusion) : The passage of drugs across the biological membrane along the concentration gradient by the protein carrier mediated system. E.g Tetracycline. Active transport: The process by which drugs pass across the biological membrane against their concentration gradient with help of carriers along with the expenditure of energy E.g levodopa Endocytosis: The process by which large molecules are engulfed by the cell membrane releases them intra cellulary E.g Toxins

## Bioavailability

The fraction of drugs that is absorbed from a given dosage forms and reaches the systemic circulation.

## Drug distribution

Passage of a drug from the blood to the tissues and organs of the body and it is determined by blood flow, to tissues, the ability of drug to exit the vascular system, and ,to lesser extent ,the ability of drug to enter cells. There are two pathological conditions – abscesses and tumors in which low regional blood flow can affect drug therapy.

## Physiological barriers for distribution of drugs

### (i) Blood brain barrier (BBB)

The term blood brain barrier refers to the unique anatomy of capillaries in the CNS. There are tight junctions' b/n cells that compose the walls of most capillaries in the CNS. These junctions are so tight that they prevent drug passage. Only drugs that are lipid soluble or have a transport system can cross the BBB to a significant degree. The presence of BBB has both merit and demerit: merit protects the brain from injury by potentially toxic substances; merit can be a significant obstacle to therapy of CNS disorders.

## Placental Barriers

The membranes of the placenta separate the maternal circulation from the fetal circulation. Lipid soluble, non – ionized compounds readily pass from the maternal blood-stream into the blood of the fetus. Drugs that have the ability to cross the placenta can cause serious harm some compounds can cause birth defects, ranging from low birth weight to mental retardation to gross malformation (e.g. Thalidomide catastrophe)



## Metabolism (Biotransformation)

Metabolism can be defined as the enzymatic alteration of drug structure

Most drug metabolism takes place in the liver.

Drug metabolism in the liver is mainly performed by cyochrome p450, a key component of enzyme system.

Possible consequences of therapeutic significance

- (i)- Accelerated renal excretion of drugs.
- (ii) –Drug inactivation.
- (iii)- Decreased or increased therapeutic action.
- (iv)- Activation of pro-drugs.
- (v)- Increased or decreased toxicity

Excretion of drugs

Drug metabolism and excretion constitute elimination of drugs.

Drug excretion can be defined as the removal of drugs and /or their metabolites out of the body.

The most important organ for drug excretion is the kidney.

Non-renal routes of drug excretion include

Breast milk

Drugs taken by breast –feeding women can undergo excretion in to milk

Mostly non –polar weakly basic drugs are accumulated in to the milk.

Lactating mother should be cautioned about the intake of these drugs

b/s they may enter into baby through breast milk and produce harmful effects in the baby. Hepatobiliary excretion

Bile is important route of excretion for certain drugs.

In some cases, drugs entering the intestine in bile may undergo Reabsorption back into the liver (enterohepatic recirculation)

Others GIT, pulmonary, sweat, saliva and tears

## 1.4 Classification of Drugs

Drugs are categorized in a variety of ways. In the pharmaceutical industry, drugs are grouped according to their chemical activity or conditions that they treat. There are many reasons to classify drugs, ranging from understanding the usefulness of types of drugs to formulating treatment plans based on chemically similar drugs

### Chemical Classifications of Drugs

Many experts disagree on how drugs should be classified. This means that the same drug might be categorized differently under two different systems. Because of this, it is virtually impossible to create a set of defining drug classification standards. However, here are some of the most common. **Alcohol:** Alcohol is one of the most widely misused substances across the world.<sup>2</sup> It is legal to consume alcohol in the U.S., even though alcohol is a central nervous system (CNS) depressant. Alcohol can create lower inhibitions and cause severe long-term damage to the liver.

**Benzodiazepines and barbiturates:** These drugs function by interacting with a neurotransmitter called GABA (gamma-aminobutyric acid).<sup>3</sup> They impact the body and mind differently but generally create calming and sedative effects. Often prescribed to treat a variety of psychiatric and sleep conditions, these drugs are highly addictive.

**Cannabis:** Cannabis is one of the most widely used drugs throughout the U.S.<sup>4</sup> It affects the cannabinoid receptors in the brain. This drug comes in many different forms and affects each user differently.

**Cocaine and other stimulants:** These drugs accelerate the activity of the CNS making a person feel alert, energized, and focused, and alert for long periods.<sup>5</sup> The converse reaction is that a person may feel angry, paranoid, and on edge.

**Hallucinogens:** By interacting with the CNS, this class of drugs alters the perception of reality, space, and time. They might cause a user to imagine situations or things that do not exist.<sup>6</sup>

**Inhalants:** Inhalants contain dangerous substances with psychoactive properties.<sup>7</sup> Most inhalants are in household items (e.g., cleaning fluids, glue, spray paint), making them easily accessible by adolescents and children. They tend to be less addictive than other substances but are incredibly dangerous.

**New psychoactive substances:** This refers to anything that is lab-created to mimic naturally occurring drugs. This includes synthetic cannabis, lab-created ketamine, and more.

**Opioids:** Opioids derive from the opium poppy plant or synthetic versions that mimic the chemical structure of opium.<sup>8</sup> This class of drugs interacts with neurotransmitters in the brain to block signals which can cause intense feelings of pleasure and reduce pain.

In the world of illicit drug use, there are essentially 7 different types of drugs. Each has its own set of characteristics, dangers, and side effects.

**Drug categories include:**

Cannabis

Depressants

Dissociative anesthetics

Hallucinogens

Inhalants

Opioids

Stimulants

Depending on the context, the following classifications may prove useful.

Chemical structure, e.g. steroids, barbiturates, benzodiazepines, glycosides

Principal pharmacological effect, e.g. bacteriostatic, diuretic, sedative, anesthetic, analgesic, purgative, antiemetic, anthelmintic, etc.

Physiological effect, e.g. parasympathomimetic, adrenergic, b-blocker, neuromuscular blocker

Diagnostic use, e.g. radio-opaque dyes for contrast radiography

Prophylactic drugs, e.g. diethylcarbamazine for heartworm prophylaxis

Placebo (Latin: 'I shall please') – pharmacologically inert but psychologically active

Poisons – recall that Paracelsus stated that 'all drugs are poisons. It is only the dose that makes a drug a poison'

Clearly, one drug may be classed a number of different ways.

## Legal Classification of Drugs

**Schedule I:** These drugs are defined as drugs that have no medical use and have a high potential for addiction and misuse. These include drugs such as ecstasy, heroin, and LSD.

**Schedule II:** These drugs have a high rate of potential misuse along with significant psychological or physical dependence. Examples of Schedule II drugs include cocaine, meth, and opioids.

**Schedule III:** These drugs have moderate to low potential for misuse. These include anabolic steroids, ketamine, and testosterone.

**Schedule IV:** These drugs have a low potential for dependence. Ambien, Ativan, and Valium are all Schedule IV drugs.

**Schedule V:** These drugs are medications usually used for analgesic, antidiarrheal, or antitussive purposes

## 1.5 Adverse Reactions of Drug

Adverse Drug Reaction (ADR) – Any noxious, unintended and undesired effect that occurs at normal drug doses

### Mild Reactions:

- ✓ Drowsiness
- ✓ Nausea, itching
- ✓ Rash

### Severe reactions:

- Respiratory depression
- Hepatocellular injury
- Anaphylaxis
- ADRs most common in
  - Elderly (>60 years old)
  - Very young (1-4 years)
  - Patients taking more than one drug

**Side effect:** “nearly unavoidable secondary drug effect produced at therapeutic doses

- Intensity is dose dependent
- Occur immediately after initially taking drug OR may not appear until weeks after initiation of drug use

**Toxicity:** “an adverse drug reaction caused by excessive dosing”

- Coma (xs morphine) Neutropenia [lower WBC count] (anti-cancer drugs make patient more susceptible to disease)

**Allergic Reactions**

- Immune response due to sensitization to drug (anaphylaxis to penicillin)
- Aspirin and sulfonamide drugs cause allergic reactions

**Idiosyncratic Effect**

- Defined as an “uncommon drug response resulting from a genetic predisposition
- Paralysis due to succinylcholine (drug used to produce skeletal muscle flaccid paralysis).
- Genetically predisposed individuals do not have enzymes to metabolize

**Iatrogenic Disease**

- “disease produced by physician” or by drugs
- Taking certain anti-psychotic drugs may induce a syndrome whose symptoms are identical to

**Parkinson’s Disease.**

- Since this is (1) drug induced and (2) essentially identical to a naturally occurring pathology it is called iatrogenic disease

**Physical Dependence**

- Long-term use of drug may lead to dependence (opioids, alcohol, barbituates, amphetamines)
- Body adapts to drug so that if drug discontinued then abstinence syndrome will develop

**Carcinogenic Effect**

- Certain medications lead to cancer
- May take >20 years to develop after initial exposure
- Tumor promotion versus tumor initiation
  - » Initiation can occur years before promotion occurs
  - » Diethylstilbestrol (DES)-- hard to study (used to stop spontaneous abortion:
    - lead to vaginal and uterine cancers years later in fetus’ that had been exposed to this drug in utero.

**Teratogenic Effect**

- Drug induced birth defect

## Drug Names

3 types of drug names

Chemical name: chemical make-up of compound: usually too complex for people to remember

Generic name: assigned by the “United States Adopted Names Council”. Only one generic name/compound (nonproprietaryname)

Trade name: proprietary (brand) name. Name by which drug is marketed

Acetaminophen (generic name) has 31 trade names (different formulations of proprietary compound)

Trade names must be approved by FDA

Over-The-Counter Drugs (OTC)

Drugs that can be purchased without prescription

OTC account for >60% of all doses administered

40% of Americans take at least one OTC drug every 2 days

## Drug tests

Testing requires 2 principle steps

Pre-clinical testing- required before new drug can be tested in humans. 1-5 years of testing in animal models after which drug is awarded “Investigational New Drug” status and clinical trials begin

- Test for toxicities
- Pharmacokinetic properties
- Test for potentially useful biologic effects

## 1.6 Pharmaceutical dosage forms and system of measurement

Pharmaceutical Dosage Forms

A dosage form is a pharmaceutical preparation consisting of drug and excipients to facilitate dosing, administration, and delivery of the content to the drug product.

The design, materials, manufacturing, and testing of all dosage forms target drug product quality.

A testing protocol must consider not only the physical, chemical, microbiological, and biological properties of the dosage form as appropriate, but also the administration route and desired dosing regimen.

## List of official dosage forms

Aerosols	Capsules
Creams	Emulsions
Films	Foams
Gases	Gels
Granules	Gums
Implants	Injections
Inserts	Shampoos
Soaps	Solutions
Sprays	Strips
Liquids	Lotions
Ointments	Pastes
Pills	Powders

## Solid Dosage Forms

Powders and Granules

Capsules and Tablets

Powders and Granules

Powders

Blending Powders

Medicated Powders

Aerosolized Powders

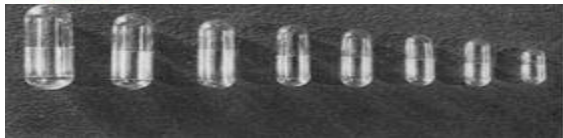
Granules

Effervescent

Capsules

Hard Gelatin Capsule

Soft Gelatin Capsules



Hard Gelatin Capsules

## Tablets

- Compressed tablets (C.T.)
- Multiple Compressed tablets (M.C.T.)
- Sugar-Coated Tablets (S.C.T.)
- Film Coated Tablets (F.C.T.)
- Gelatin Coated Tablets
- Enteric Coated Tablets (E.C.T.)
- Buccal or Sublingual Tablets
- Chewable Tablets
- Effervescent Tablets
- Immediate release Tablets (I.R.)
- Instant Disintegrating /Dissolving Tablets
- Extended release Tablets (E.R.)
- Vaginal Tablets

## Tablets



Compressed tablets



Cross Section



Top view



Sugar-Coated Tablets



Film Coated Tablets



Gelatin Coated Tablets



Enteric Coated Tablets

## 1.7 Dosage calculations



There are 3 primary methods for calculating medication dosages; Dimensional Analysis, Ratio Proportion, and Formula or Desired Over Have Method..

Desired Over Have or Formula Method uses a formula or equation to solve for an unknown quantity (x), much like ratio proportion.

Drug calculations require using conversion factors, for example, when converting from pounds to kilograms or liters to milliliters. Simplistic in design, this method allows clinicians to work with various units of measurement, converting factors to find the answer. These methods are useful in checking the accuracy of the other methods of calculation, thus acting as a double or triple check.

### **Preparation**

When clinicians are prepared and know the key conversion factors, they will be less anxious about the calculation involved. This is vital to accuracy, regardless of which formula or method is employed.

### **Conversion Factors**

$$1 \text{ kg} = 2.2 \text{ lb}$$

$$1 \text{ gallon} = 4 \text{ quart}$$

$$1 \text{ tsp} = 5 \text{ mL}$$

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$1 \text{ L} = 1,000 \text{ mL}$$

$$1 \text{ kg} = 1,000 \text{ g}$$

$$1 \text{ oz} = 30 \text{ mL} = 2 \text{ tbsp}$$

$$1 \text{ g} = 1,000 \text{ mg}$$

$$1 \text{ mg} = 1,000 \text{ mcg}$$

$$1 \text{ cm} = 10 \text{ mm}$$

$$1 \text{ tbsp} = 15 \text{ mL}$$

$$1 \text{ cup} = 8 \text{ fl oz}$$

$$1 \text{ pint} = 2 \text{ cups}$$

$$12 \text{ inches} = 1 \text{ foot}$$

$$1 \text{ L} = 1.057 \text{ qt}$$

$$1 \text{ lb} = 16 \text{ oz}$$

$$1 \text{ tbsp} = 3 \text{ tsp}$$

$$60 \text{ minute} = 1 \text{ hour}$$

1 cc = 1 mL

2 pints = 1 qt

8 oz = 240 mL = 1 glass

1 tsp = 60 gtt

1 pt = 500 mL = 16 oz

1 oz = 30 mL

4 oz = 120 mL (Casey, 2018)

## Unit of Measurement

List a definite magnitude of a quantity, defined and adopted by convention or by law, that is used as a standard for measurement of the same. Units of measurement must match, for example, milliliters and milliliters, or one needs to convert to like units of measurement. In the example above, the ordered dose was in milligrams, and they have dose was in milligrams, both of which cancel out, leaving milliliters (answer called for milliliters), so no further conversion is required.

You should always systematically look at the process of drug delivery to calculate drug doses safely by doing the following:

1. Recognize the way drugs are packaged and how to look for the information on the labels needed to calculate drug doses.
2. Look at the orders and how these are presented on the medication administration record (MAR).

## Reading Drug Labels

Drug labels give important information used to obtain the correct dosage. Although labels contain a great amount of information about the drug being given, three specific items are needed to administer a drug: the name, form, and dosage strength. Drug labels may contain two names: the trade (brand) name and the generic name. The trade name is usually capitalized, written first on the label, and identified by the registration symbol. The generic name is written in smaller print, often in parentheses, and usually located under the trade name. Drugs may be prescribed by either the trade name or the generic name.

Often the generic drug is less expensive than the brand-name drug. If the primary health care provider does not specify that a substitution *cannot* be made, it is likely that a generic version of the drug will be dispensed to reduce the cost to the patient. Problems can arise if a patient recognizes the brand name of a drug but does not know the generic name and refuses the medication (companies that make generic-only drugs do not include a trade name on the label). Therefore, it is important to know the generic name of drugs and always check for brand-name versions if the patient questions the prescription. The nurse must then determine the number of capsules/tablets or the amount of solution to administer . Therefore, the nurse must know the amount of drug in each tablet or capsule (dosage strength) . The dosage strength is also given on the container . The dosage strength is used to calculate the number of tablets or the amount of solution to administer.

## Basic Formula Method of Dosage Calculation

Once the nurse has identified the basic information about the drug, the calculation can be performed to prepare the drug.

### Basic Formula Method by Hand

To find the correct dosage of a solid oral preparation, such as a tablet, the following formula may be used

$$\frac{\text{dose desired}}{\text{dose on hand}} = \text{dose administered (the unknown or X)}$$

This formula may be abbreviated as:

$$\frac{D}{H} = X$$

When the dose ordered by the primary health care provider (dose desired) is written in the same *measurement* as the dose on the drug container (dose on hand) (e.g., they are both milligrams), then these two figures may be inserted into the formula without changes.

### Examples

The nurse or physician orders cimetidine 800 mg (milligrams).

The drug is available as cimetidine 400 mg (milligrams). We put numbers in place of letters in the above equation.

$$\frac{800 \text{ mg (dose desired)}}{400 \text{ mg (dose on hand)}} = 2 \text{ tablets of 400 mg cimetidine}$$

## Metric system of measurement

If the primary health care provider orders ascorbic acid (vitamin C) 0.5 g, and the drug container label reads ascorbic acid 250 mg, a conversion of grams to milligrams (because the drug container is labeled in milligrams) would be necessary before the basic formula can be used. Therefore, it is important for the nurse to understand the **metric system** of measurement. To review, there are three systems of measurement associated with drug dosing:

- (1) the metric system,
- (2) the apothecary system, and (3) household measurements.

The metric system is the most commonly used system of measurement in medicine.

The metric system uses decimals (or the decimal system)

. In the metric system, the **gram** is the unit of weight, the **liter** the unit of volume, and the **meter** the unit of length.

## Ratio and Proportion Method of Dosage Calculation

### Converting Units for Calculation

When using the basic formula, the **numerator** and the **denominator** must be of like terms—for example, milligrams over milligrams or grams over grams.

To set up a problem, a fraction must be stated in like terms; therefore, proportion may be used to convert grams to milligrams.

### Example

Convert 0.5 gram (g) to milligrams (mg); using proportion and the known equivalent 1000 mg =

1 g, set up the ratio: 1000 mg : 1 g :: X mg : 0.5 g

$$X = 1000 \times 0.5$$

$$X = 500 \text{ mg}$$

*Or*

$$\begin{aligned} \frac{1000 \text{ mg}}{1 \text{ g}} &= \frac{X \text{ mg}}{0.5 \text{ g}} \\ X &= 1000 \times 0.5 \\ X &= 500 \text{ mg} \end{aligned}$$

Therefore, 0.5 gram (g) equals 500 milligrams (mg). After changing 0.5 g to 500 mg, use the basic method formula:

$$\frac{D}{H} = X$$

Now replace the letters with numbers in the equation.

$$\frac{500 \text{ mg}}{250 \text{ mg}} = 2 \text{ tablets of } 250 \text{ mg ascorbic acid}$$

### 3. Household System

Less accurate system of measurement, mainly used in the home where dosages can be expressed in terms of common household measurement teaspoon(tsp),tablespoon(tabsp), and liquid ounces(oz)

#### Calculating Dosage

The proportion equation is useful for calculating dosages

Proportion is a mathematical equation that expresses the equality b/n two rations

$$\text{e.g. } 25:5 = 50:10$$

### Example 1

Morphine sulfate (analgesic) injection for iv use is available in a concentration of 8mg/ml. Calculate the number of ml required to administer a dosage of 20mg of morphine sulfate.

$$8\text{mg}/1\text{ml} = 20\text{mg} / x\text{ml} \quad \rightarrow x = 2.5\text{ml}$$

### Example 2

There is a drug order for 60mg of drug. The drug is available in 20mg tablets. How, many tables are required.

$$\text{Desired dosage} = \frac{60\text{mg}}{20\text{mg}} = 3 \text{ tablet}$$

$$\text{Available dosage} = 20\text{mg}$$

### Pediatric dosage calculations

Dosage calculations in pediatrics are based on age body surface area and body weigh

#### Young's rule

$$\text{Child's dose} = \frac{\text{Age of child}}{\text{Age of child} + 12} \times \text{adult dose}$$

#### Clark's rule

$$\text{Child's dose} = \frac{\text{weight of child}}{150 \text{ pounds(Ib)}} \times \text{adult dose}$$

#### Fried's rule

$$\text{Child's dose} = \frac{\text{Age in months}}{150} \times \text{adult dose}$$

Body surface area rule (BSA) rule

$$\text{Child's dose} = \frac{\text{BSA of child (in m}^2\text{)}}{1.7} \times \text{adult dose}$$

### DRUGS IN LIQUID FORM

Drugs may be ordered in liquid form for many reasons:

The patient is a child,

The drug is to be put in a feeding tube or injected directly into the tissues or intravenous (IV) line, or

the patient is too ill to swallow a solid form of the drug like a tablet. In these situations, the drug is made in a solution form.

## Solutions

A solute is a substance dissolved in a **solvent** to make a solution. Usually, water is used as the solvent for preparing a solution unless another liquid is specified. Most solutions are prepared by a clinical pharmacist or the manufacturer and not by the nurse. It is important for the nurse to understand how the solutions are prepared and labeled. Examples of how solutions may be labeled include:

- 10 mg/mL—10 mg of the drug in each milliliter
- 1:1000—a solution denoting strength of 1 part of the drug per 1000 parts of solvent
- 5 mg/teaspoon—5 mg of the drug in each teaspoon of solution (home use)

## Dose Calculations with Liquids

With drugs in liquid form, there is a specific amount of drug in a given volume of solution.

For example, the dosage strength of Augmentin is 125 mg in 5 mL of solution (typically written as 125 mg/5 mL). Instead of labeling the drug in one unit of measure (tablet or capsule), the drug is written as a specific amount of drug in a specific quantity of solution. For example, if the label states that there is 125 mg/5 mL, 5 mL is the quantity (or volume) in which there is 125 mg of this drug. For example, the health care provider may order 500 mg Augmentin and the drug is labeled as 125 mg/5 mL.

$$\frac{D}{H} \times Q = X \text{ (the liquid amount to be given)}$$

The 5 mL is the amount (quantity or Q) that contains 125 mg of the drug

$$\frac{500 \text{ mg}}{125 \text{ mg}} \times 5 \text{ mL} = X$$

$$\frac{4}{1} \times 5 = 20 \text{ mL}$$

Therefore, 20 mL contains the desired dose of 500 mg of Augmentin.

## Drugs Therapy and Nursing Management

Part of the nurse's role, alongside the pharmacist, is the need to ensure that medicines are administered appropriately. That is why it is essential that the nurse has a good knowledge and understanding of pharmacology and the relevant calculations in terms of patient care. Each patient is unique in ability to respond and to how they each respond, but formation of "IDEAL DRUG" will lessen this variation.

Age-very important factor

- Sex-due to hormonal differences
- Weight- less effective and longer lasting in obese individuals (storage in fat)
- Kidney & liver functions - elimination of drug
- Genetic variables- tolerance, allergy (though not always genetic)

## Application of Pharmacology in Nursing Practice

Nurse's "Five Rights of Drug Administration"

- Use the RIGHT drug
- Give to the RIGHT patient –
- Give the RIGHT dose
- Give by the RIGHT route
- Give at the RIGHT time

Must also be ready to respond to interaction between drug and patient (i.e., must be aware of drug REACTIONS and SIDE EFFECTS)

Nurse must have knowledge of

- Patient history and drug usage
- What medications are appropriate and be aware of drug interactions (cooperation between doctor, pharmacist and nurse)

Drug actions and look for abnormal effects

How to be a patient advocate- check for mistakes on part of doctor or pharmacist!!

- Do NOT blindly follow Dr's orders-- THINK and respond to errors [ do not be intimidated]



## Patient Care

### Pre-administration Assessment

- Collecting baseline data to evaluate therapeutic and adverse responses (e.g., get blood pressure data and cell counts to use to determine whether drugs are effective)
- Identifying high-risk patients (e.g., liver/kidney dysfunction, genetic factors, allergies, pregnancy, old age and extreme youth)
- Assessing the patient's capacity for self-care (can they follow directions on their own)

First two assessments are drug specific & last assessment is for any patient and drug

### Drug Administration

- Drugs may have more than one indication, i.e. each may have more than one action depending upon dosage

Aspirin given in low doses to relieve pain & high doses to suppress inflammation (arthritis)

Drugs can be administered by different routes and dosage depends on route given

Oral doses usually larger than injected doses (sc, im, ip, im, iv) and may be fatal if given by incorrect route

Certain iv drugs can cause local injury if intravenous line becomes extravasated and Nurse must monitor this

### Therapeutic Effects

Is the drug doing the right thing? Evaluation criteria

- Must know rationale for treatment and the nature and time course of desired response
- If do not have this then cannot make judgment of progress
  - If desired response do not occur then must act quickly

Give alternative therapy

Even if patient gains beneficial responses, must be aware of what drug is supposed to do, because it still might end up badly

Nifedipine: given for hypertension & angina pectoris: when given to treat hypertension should monitor for reduction in blood pressure; if used for treatment of angina, need to monitor for reduction in chest pain

### **Compliance**

- Drugs must be taken correctly
  - Wrong dose
  - Wrong route
  - wrong time causes non compliance *and should be avoided and educate*
- Educate patients throw to self medicate with specific instructions and Implement Non-drug measures to enhance drug effects like breathing exercises, , emotional support, exercise, physical therapy, rest, weight reduction, stop smoking, and sodium restriction (must evaluate individual patient for specific needs)

### **Minimize Adverse Effects**

patient history

- Understand disease and treatment and what drug is supposed to do (again, do not give drug blindly!!!)
- Identify high risk patient
- Educate patient
- Know adverse effects of drug and educate patient to these
- Know drug interactions with other medications

## **1.9 Drugs affecting the gastrointestinal system**

Drug for upper GI

Drugs for peptic ulcer disease (PUD)

PUD refers to a group of GI disorders characterized by varying degrees of erosion of the gut wall, a mucosal lesion of the stomach or duodenum.

Occurs when gastro- duodenal mucosal defenses are unable to protect the epithelium from the corrosive effects of acid and pepsin,

Causes include: Helicobacter pylori, stress, non steroidal anti-inflammatory drugs and others.

Drugs used include the following

Antacids

Histamine H<sub>2</sub>- receptor antagonists

Proton- pump inhibitors

Others:

Antacids

Alkaline compounds that neutralize stomach acid

E.g. Aluminum hydroxide,, magnesium hydroxide, Magnesium trisilicate,

Indications of antacids

In the treatment of hyperacidity such as heart burn gastro esophageal reflux disease sour stomach  
PUD

Antacids act within 5-15 minutes, but their effects usually last only for 2 hours. Since they relieve pain from hyperacidity, they often are used in conjunction with other drug therapy.

### **Adverse effects**

Systemic antacids such as NaHCO<sub>3</sub> can produce systemic alkalosis;

Aluminum compounds can cause constipation, will magnesium compounds can cause diarrhea, and thus the combination balances the effects on bowel function.

E.g. Aluminum hydroxide + Magnesium trisilicate

With sodium compounds the risk of over hydration and hypervolemia increase.

Aluminum may interact with absorption of dietary phosphate.

Hypomagnesaemia reduces impulse transmission causing sedation and weakness

Drug interactions:

with tetracycline's and quinolone antibiotics such as ciprofloxacin antacids form non absorbable complex and hence can reduce their effectiveness

Azole antifungal need acidic environment for absorption

Precautions and contraindications

Antacids are contraindicate in patients with sever abdominal pain of unknown origin and during lactation.

Use magnesium and aluminum antacids in caution in patients with kidney disease and gastric outlet obstruction.

#### Preparations

- Aluminum Hydroxide; mixture or Gel, 320mg/ 5ml; suspension, 360mg/5ml
- Aluminum hydroxide + magnesium Hydroxide suspension, 200mg + 195 mg in 5ml, tablet (chewable) 400mg + 400mg
- Aluminum Hydroxide + magnesium Tricilate suspension, 310 mg + 620 mg in 5ml; Tablet (chewable) 120mg + 250mg; 250mg + 500mg.
- Magnesium Hydroxide, mixture, 375 mg/ 5ml; Tablet (chewable)

Dosage; mixture of magnesium trisilicate and Aluminum hydroxide 10-30ml or 2-4 chewable tablets, p.o b/n meals and at bed time for 4 weeks

#### Histamine H<sub>2</sub>-receptor antagonists

Examples: - Cimetidine                      Famotidine  
                  Ranitidine                     Nizatidine

They are used for the treatment of peptic ulcer and duodenal ulcers; promote ulcer healing by suppressing secretion of gastric acid.

#### Cimetidine

##### Mechanism of action:

By blocking H<sub>2</sub>- receptors cimetidine reduces secretion of hydrochloric acid and reducing total pepsin output; the resultant decrease in acid allows healing of ulcerated areas.

##### Pharmacokinetics

May be given, orally, IV or im.

Food decreases the rate of absorption but not the extent.

Half- life is relatively short (about 2 hours) but increases in patients with renal impairment thus dosage should be reduced in these patients.

##### Indications:

Peptic ulcer diseases

Gastro esophageal reflux disease

Zollinger Ellison syndrome, moreover

#### Adverse effects

Anti androgenic effects: by binding to androgen receptors cimetidine produces receptor blockage. This action result in gynecomastia, reduced libido and impotence.

CNS effects: confusion, restlessness, delirium confusion and coma.

Others: GI Effects; diarrhea, nausea: Hematological effects .thrombocytopenia and granulocytopenia occurs rarely.

#### Drug Interactions

Cimetidine inhibits hepatic drug metabolizing enzymes and hence can cause levels of other drugs to raise e.g. warfarine, phenytion, and lidocaine.

#### Precautions/ contraindications

Allergy to histamine<sub>2</sub> antagonist, impaired renal or hepatic function, or lactation.

Preparations: Cimetidine injection 200mg/ml, in 2ml ampoule; syrup-200mg/5ml,  
Tablets, 200mg, 400mg, 800mg

Dosage: For PUD 400mg, bid, with breakfast and at night for 2 weeks.

#### Ranitidine

Ranitidine is more potent than cimetidine; produces fewer adverse effects i.e. it has no anti-androgenic effects and CNS effects are rare, moreover ranitidine doesn't inhibit hepatic microsomal enzymes.

Preparations: ranitidine injection, 100mg/ml in 5ml ampoule, 25mg/ml in 10ml ampoule  
; Tablet, 150mg.

Dosage: 150mg po, bid or 300mg at bed time for 4weeks.

#### Famotidine

Very similar to ranitidine

Preparations tablet: 20mg, 40mg.

Dosage: 40mg, p.o at night for 4-6 weeks.

#### Proton pump Inhibitors

Examples Omeprazole Robeprazole Lasonoprazole

Omeprazole

#### Action:

The active form of the drug causes irreversible inhibition of  $H^+$ ,  $K^+$ -  $ATP_{ase}$  –the enzyme that generates gastric acid.

#### Pharmacokinetics

Because the drug is acid labile, it is dispensed in capsules that contain protective enteric -coated granules : the plasma half life is short ( about 1 hr ) however, since it acts by irreversible enzyme inhibition –its effects persist long

#### Indications:

For short term therapy of PUD, GERD,

For long term therapy of hypersensitivity conditions

#### Adverse effect

With short term therapy head ache , diarrhea ,nausea and vomiting with long term therapy there may be a risk of cancer.

Contraindications: pregnancy, lactation

Preparation: capsule, 20mg

Dosage: 20mg p.o daily for 4-8 wks.

Other drugs: sucralfat, misoprostol , bismuth salts .

PUD associated with *H .pylori*

Antibiotics are included in the drug regimen.

#### First line

Amoxicillin (1gm p. o, bid) + clarithromycin (500mg p.o, bid) + omeprazole (20mg p.o, bid) for 7- 14 days.

#### Alternatives

Amoxicillin (1gm p.o, bid) + metronidazole(500mg p.o, bid)+ omeprazole (20mg p.o, bid) for 7- 10 days

N.B: Bismuth salts can be indicated in the regimen.

Drug for lower GI

Laxatives

Laxatives are used to ease or simulate defecation they can soften the stool, increase stool volume, hasten fecal passage through the intestine and facilitate evacuation from the rectum.

Indications for laxative use

constipation

To reduce painful elimination that can be associated with hemorrhoids and other anorectal lesions

To decrease the amount of straining needed to defecate in patient with CVS disease(such as myocardial infarction ,disease of the cerebral or cardiac vasculature)

As an adjunct to anthelmintic for facilitating the export of dead parasites

Contraindications for laxative use

Individuals experiencing abdominal pain, nausea, cramps or other symptoms of appendicitis, ulcerative colitis.

Patients with acute surgical abdomen

In the presence of fecal impaction or obstruction of the bowel.

Shouldn't be employed habitually for constipation

Classification of laxatives

Classified according to mechanism of action

Bulk forming Laxatives

Examples: methylcellulose Psyllium

These agents are non- digestible and nonabsorbable, swell in water to form a viscous solution or gel, thereby soften the fecal mass and increase its bulk swelling of the fecal mass stretches the intestinal wall thereby stimulating peristalsis.

Indications-

constipation

### **Adverse effects**

Esophageal obstruction if swallowed in the absence of sufficient fluid (should be given with full glass of water or juice)

Preparations: methylcellulose tablet 500mg, powder; psyllium, powder

Dosage: methylcellulose powder 1tbsp in 8 oz cold water 1-3 times a day

Psyllium 1 rounded tsp(or 1 packet) mixed with water or other fluid, taken 1-3 times a day.

Stimulant laxatives

Examples: Cascara                  Senna

Castor oil                  Biscodyl

Have two effects on the bowel

stimulate intestinal motility

Increase the amount of water and electrolytes with in the intestinal lumen.

- Most of them act on the colon producing a semi fluid stool with 6-12 hours.
- Biscodyl can be administered by rectal suppository as well as by mouth.
- Castor oil is the only stimulate laxative that acts on the small intestine, as a result it acts quickly (in 2-6hours) to produce a watery stool.

Preparations Biscay suppository 5mg, 10mg; tablet, 5mg

Senna tablet: 7.5mg

Cascara sagrada: tablet 125mg.

Dosage: For chronic constipation

Cascara, 40mg, po at night.

Biscodyl, 5-10mg, po at night or 10mg rectally in the morning.



NB. Biscodyl is not indicated for children below 4 years.

#### Surfactant Laxatives

Examples; Docustate sodium

Produce a soft stool several days after the onset of treatment

Alter stool consistency by lowering surface tension, which facilitates penetration of water into the feces.

Preparations: Docustate sodium syrup 4mg/ml; tablet, 500mg, 100mg.

Dosage: 50-500mg/day with a full glass of water.

#### Osmotic Laxatives

Examples: magnesium sulfate

These are poorly soluble salts whose osmotic action draws water into the intestinal lumen; accumulation of water causes the fecal mass to soften and swell, swelling, in turn stretches the intestinal wall and thereby stimulates peristalsis.

High dose therapy is employed to empty the bowel in preparation for diagnostic and surgical procedures, and to evacuate dead parasites following anthelminthic therapy.

#### Adverse effects

Can cause substantial loss of water, to avoid dehydration treatment should be accompanied by augmented intake of fluids.

Although they are poorly and slowly absorbed, some absorption can take place: in patients with renal dysfunction magnesium can accumulate to toxic levels, sodium absorption can cause fluid retention, which in turn can exacerbate heart failure, hypertension and edema.

#### Contraindications

Magnesium containing laxatives in patients with renal dysfunction

Sodium containing laxatives in patients with heart failure, hypertension, edema.

Preparations: magnesium sulfate, crystals in sachets

Dosage: 10-20mg po in a glass of water, preferably before breakfast.

#### Miscellaneous Laxatives

Lactulose

Poorly absorbed and can not be digested by intestinal enzymes

It should be reserved for patients who do not respond adequately to bulk forming laxatives.

It also enhances the intestinal excretion of ammonia thus used in patients with portal hypertension and hepatoencephalopathy occurring secondary to chronic liver disease.

Preparations: enema, syrup.

Glycerin

An osmotic agent that softens and lubricates feces.

May stimulate rectal contraction.

Useful for reestablishing normal bowel function following termination of chronic laxative use.

Preparations: suppositories, 1g, 1.36g, 2g, 2.76g.

Dosage: 1g, rectally at night after moistening with water.

Anti emetics

Anti emetics are given to suppress vomiting

### **The Emetic Response**

Emesis is a complex reflex brought by activation of vomiting center; some stimuli activate the vomiting center directly others act indirectly.

Direct acting stimuli include signals from sensory organs, (upsetting sights, noxious odors, or pain), signals from the cerebral cortex (anticipation or fear) and signals from the vestibular apparatus of inner ear.

Indirectly acting stimuli first activate the chemoreceptor trigger zone (CTZ) which in turn activates the vomiting center. Activation of the CTZ occurs by signals from the stomach and small intestine (traveling along vagal afferents; and by direct action of emetogenic compounds such as anticancer drugs, opioids) that are carried to the CTZ in the blood.

Several types of receptors are involved in the vomiting response for e.g. receptors for serotonin, dopamine, Ach, and histamine. Many antiemetics act by blocking one or more of these receptors.

### **Drugs**

Serotonin receptor antagonists

E.g. Ondasetron.

Dopamine antagonists.

Chlorpromazine, Haloperidol, metoclopramide.

Anticholinergics

Scopolamine/Hyoscine.

Antihistamines (for motion sickness)

Dimenhydrinate, Meclizine, Cyclizine.

Antidiarrheal Agents

Diarrhea is characterized by stools of excessive volume and fluidity and by increased frequency of defecation.

Causes include infection, maldigestion, inflammation and functional disorders of the bowel e.g. irritable bowel syndrome.

The most serious complications of diarrhea are dehydration and depletion of electrolytes.

Management of diarrhea is directed at the following points.

Replacement of lost water and salts.

Diagnosis and treatment of the underlying cause.

Relief of cramping.

Reducing the passage of unformed stools

Antidiarrheal drugs fall into two major groups:

Specific antidiarrheal drugs: drugs that are used to treat the underlying cause.

E.g. anti-infective and drugs used to correct mal-absorption

Non-specific drugs: that act on or within the bowel to provide symptomatic relief; these agents do not influence the actual cause of diarrhea.

Opioids: by activating opioid receptors in the GIT, decrease intestinal motility and thereby slow intestinal transit, which allows more time for absorption of fluid and electrolytes.e.g. Diphenoxylate, loperamide, opium tincture (Note: they have abuse potential).

ORS: oral rehydration salt- for replacement of fluid and electrolytes.

Anticholinergics e.g. atropine, scopolamine.

Antispasmodics

Are indicated to reduce GI spasm

Atropine sulfate injection.

Hyoscine/scopolamine butylbromide.

Propantheline bromide.

*Nursing responsibility*

Give careful mouth care

Advise the client not taking antacids j food

Recommend small frequent feeding

Discourage repeated use of stimulant

Promote rest for client with diarrhea

Monitor fluid & electrolyte balance

### 1.10 Anti - inflammatory drugs

Inflammation is a process by which your body's white blood cells and the things they make protect you from infection from outside invaders, such as bacteria and viruses.

**Inflammation** is local response to injury or infection characterized by swelling, pain heat and redness.

**Anti-inflammatory** is the property of a substance or treatment that reduces inflammation or swelling.

Anti-inflammatory drugs, also called **anti-inflammatories**, make up about half of analgesics. These drugs remedy pain by reducing inflammation as opposed to opioids, which affect the central nervous system to block pain signaling to the brain.

Can be classified in to *Steroid and Non steroidal anti inflammatory drugs*

#### **Non – Steroidal Anti inflammatory Drugs (NSAIDS)**

Are members of a therapeutic drug class which reduces pain, decreases inflammation, decreases fever, and prevents blood clots. Side effects depend on the specific drug, its dose and duration of use, but largely include an increased risk of gastrointestinal ulcers and bleeds, heart attack, and kidney disease

Non- steroidal anti-inflammatory drugs (NASIDs) suppress the signs and symptoms of Inflammations

#### ***Mechanism of action***

NSAIDs work by inhibiting the synthesis of molecules known as prostaglandins, which are important mediators of inflammation and pain. Prostaglandins are synthesized in the blood vessel wall and act locally to relax blood vessels, resulting in increased blood flow. Following insult or injury to tissues, this process results in inflammation.

Most NSAIDs act as nonselective inhibitors of the cyclooxygenase (COX) enzymes, inhibiting both the cyclooxygenase

NSAIDs are also used in the acute pain caused by gout because they inhibit urate crystal phagocytosis besides inhibition of prostaglandin synthase

### Side effects of NSAIDs

indigestion – including stomach aches, feeling sick and diarrhoea.

stomach ulcers – these can cause internal bleeding and anaemia; extra medicine to protect your stomach may be prescribed to help reduce this risk.

headaches.

drowsiness.

dizziness.

allergic reactions.

### List of non steroid anti inflammatory drugs drugs

Aspirin	Indomethacin
Ibuprofen	Proxicam
Tenoxicam	Diclofenac
Ketoprofen	Celecoxib

**Action:** inhibit the enzyme cyclooxygenase (COX) this enzyme converts arachdonic acid in to prostaglandins; prostaglandins are mediators of inflammatory process..Cyclooxygenase is found in all tissues and helps regulate multiple processes, it has two forms named COX<sub>1</sub> and COX<sub>2</sub> . COX<sub>1</sub> is found in particularly all tissues where it mediates “house keeping” chores. Important among these are protecting the gastric mucosa, supporting renal function and etc.In contrast, COX<sub>2</sub> mainly produced at sites of tissue injury. At these sites, COX<sub>2</sub> catalyzes the synthesis of prostaglandins; which promote inflammation, sensitize pain receptors to stimuli and moreover in CNS COX<sub>2</sub> mediated prostaglandin participates in pyretic action.

## Therapeutic use

Suppression of inflammation

Relief of pain

Reduction of fever

## Aspirin

Action:

It is an irreversible non selective inhibitor of COX

## Pharmacokinetics

Absorbed rapidly and completely following oral administration.

Metabolized into salicylic acid, active metabolite.

Salicylic acid and its metabolites are excreted by the kidney, raising the  $P^H$  of urine increases its excretion.

## Therapeutic use

suppression of inflammation: rheumatoid arteritis, osteoarthritis and others

Analgesia: to relief mild to moderate pain.

Reduction of fever: antipyretic action.

Dysmenorrhea

Suppression of platelet aggregation: reduction of risk of death(in males) in patients with history of MI or unstable angina pectoris.

## Adverse Effects

GI effects: gastric distress, heart burn and nausea (can be reduced by taking aspirin with food or a full glass of water) long term high dose therapy can cause gastric ulceration,. perforation and bleeding

Bleeding:- Aspirin can promote bleeding by inhibiting platelet aggregation

Renal impairment:- Aspirin can cause acute reversible impairment of renal function

Salicylism: - characterized by tinnitus (ringing in the ears) sweating, head ache dizziness and mental confusion..

Reye's syndrome: rare but serious illness of child hood ,it occurs in children who have influenza or chickenpox

Hypersensitivity reactions

Acute toxicity: respiratory alkalosis.

### **Drug interactions**

With warfarine and heparin the risk of bleeding increases.

Concomitant use with alcohol, steroids and other NSAIDs increases the risk of gastric bleeding.

Increased risk of salicylate toxicity with furosemide.

Increased effects of valproic acid secondary to displacement from plasma binding sites.

### **Contraindications and precautions**

Allergy to salicylates and other NSAIDs (more common in patients with asthma, rhinitis, chronic urticaria)

Cardiovascular dysfunction:

In children who have influenza or chickenpox.

Peptic ulceration, GI bleeding.

Pregnancy especially in 3<sup>rd</sup> trimester and lactation.

Use cautiously in patients with impaired renal and hepatic function.

Dosage

For aches and pain, fever 325- 650 mg q 4 hrs

Rheumatoid arthritis 3.6-5.4gm/ day in divided dosage

## **Ibuprofen**

Like aspirin it has anti –inflammatory, analgesic and antipyretic action.

It is used to treat fever mild to moderate pain and arthritis.

It is superior to most other NSAIDs for relief of primary dysmenorrhea b/s it produces good inhibition of COX in uterine smooth muscles.

It produces lesser gastric bleeding and inhibition of platelet aggregation than aspirin. Consequently it is among the safer NSAIDs for use with anticoagulants.

### **Adverse effects**

CNS: headache, dizziness, insomnia, fatigue

GI: nausea, dyspepsia, GI pain, diarrhea, flatulence

Hematologic; bleeding, platelet inhibition with higher doses.

Dermatologic: rash, Pruritis, sweating.

Renal: dysuria, renal impairment.

### **Drug interactions**

Increased serum levels and increased risk of lithium toxicity.

Decreased diuretic effect with loop diuretics.

Decrease in hypertensive effect of beta adrenergic blocking agents.

### **Contraindications and precautions**

Allergy to salicylates and other NSAIDs(Cardiovascular dysfunction:

Peptic ulceration, GI bleeding.

Cardiovascular dysfunction.

Precaution: impaired renal or hepatic function.

Pregnancy especially in 3<sup>rd</sup> trimester and lactation.

### **Dosage**

Analgesia, primary dysmenorrhea: 400mg po qid.

#### **Diclofenac**

Diclofenac is approved for rheumatoid arthritis, osteoarthritis and primary dysmenorrhea

The most common adverse effect are abdominal pain, nausea by impairing renal function, diclofenac can cause fluid retention which can exacerbate hypertension and heart failure. It is preferred in patients with peptic ulcer disease

### **Drug interaction**

Increased serum levels and increased risk of lithium toxicity.

### **Contraindication and precautions:**

significant renal impairment,

Pregnancy especially in 3<sup>rd</sup> trimester and lactation.

Precautions: impaired renal function, GI and CV conditions.

### **Dosage**

For analgesia, 50mg tid po.

#### **Paracetamol**

Paracetamol has analgesic and antipyretic effects but it doesn't have anti-inflammatory effect, because it inhibits cyclo oxygenase in the CNS. Accordingly it lacks anti-inflammatory effects. More importantly, paracetamol is devoid of adverse effects of NSAIDs that arises from inhibition of COX1 in the periphery such as, gastric ulceration, renal impairment, and platelet



inhibition. In general it is safer to use in patients with peptic ulcer disease, renal impairment and children with chicken pox and influenza.

Adverse effects

With over dosage it is highly hepatotoxic, hypersensitivity reactions

Contraindications/precautions

Allergy

Caution, with impaired hepatic function, chronic alcoholism, pregnancy, lactation.

### **Steroidal anti inflammatory drugs**

Example: betamethasone

prednisolone

Cortisone

Dexamthasone

-hydrocortisone

Adrenal corticosteroids are important in the body's Maintenance of homeostasis due to their profound influence on body metabolism.

They are also useful when the effect of the inflammatory or immunologic processes threaten the patient's life or well being.

### **Action**

Corticosteroids exert their anti – inflammatory action by lysosomal stabilization, inhibition of leucocytes response or biosynthesis and inhibition of synthesis of prostaglandins.

### **Adverse effects-**

If a patient has been treated for a short period adverse effects are mild and reversible but with long term therapy severe and irreversible adverse effects can occur.

Every other day dosage schedule or once daily dosage can be used to minimize.

Some of the adverse effects include risk of Infection, Osteoporosis, diabetes mellitus, fat redistribution, fluid retention, muscular wasting.

### **Drug interactions**

Increased risk of GI bleeding with NSAIDs.

Decreased effect of hypoglycemic agents

Decreased antibody response to vaccines.

### **Contraindications and precautions**

Contraindications: for patients with systemic fungal infection, for those receiving live viral vaccines.

Precautions: in pediatric patients, pregnancy, lactation, hypertension, heart failure, renal impairment, diabetes,

Note: these drugs should not be withdrawn abruptly; they should be withdrawn slowly over 5- 7 days.

### **Drug Therapy of Rheumatoid Arthritis**

Rheumatoid arthritis (RA) is an auto immune inflammatory disorder.

Onset of RA is heralded by symmetric joint stiffness, pain; joints become swollen tender and warm.

In addition to joint injury RA has systemic manifestations such as fever, weakness fatigue, weight loss, thinning of the skin etc.

### **Drugs**

1. Non- steroidal anti- inflammatory drugs.

e.g. Ibuprofen- 600- 800 mg TID/QID

Aspirin - 800 mg., tid

Diclofenac 150- 200 mg / day

2. Disease modifying anti rheumatic drugs (DMARD)

These are drugs that used to reduce joint destruction and retard disease progression.

They are used if symptoms can't be controlled by NSAID or they can be used early within 3 months of diagnosis to delay joint degeneration.

E.g. methotrexate, Hydroxyl chloroquine, sulfasalazine .

### **Hydroxy chloroquine**

Action and use:- This is a drug with anti malarial actions, is a preferred DMARD for patient with mild symptoms.

Dosage: - initial 200 mg, bid; maintenance dosage 200 – 400 mg / day

3. Glucocorticoids

These are anti- inflammatory drugs that can relieve symptoms of severe RA

For patients with generalized symptoms oral glucocorticoid (prednisone and

prednisolone) are indicated. However if one or two joints are affected intra- articular injection may be employed.

Most often these drugs are given to provide temporary relief until drugs with a slower onset of acting (e.g. methotrexate) can provide control.

Long term therapy should be limited to patients who have failed to respond adequately to all other treatment options.

Dosage 10-20mg/dl until symptoms are controlled followed by drug with drawl over 5-7 days.

### **Drug Therapy of Gout**

Gout is recurrent inflammatory disorder characterized by hyper uremia (high blood levels of uric acid) and episodes of sever joint pain typically in the large toe.

Hyper uremia can occur

Excessive production of uric acid

Impaired renal excretion of uric acid

### **Drugs**

Colchicine and indomethacine relief inflammation;  
allopurinol and probencid reduce hyper uricemia.

### **Colchicine:-**

This is anti inflammatory agent whose effects are specific for gout, used for acute attacks of gout.

#### **Adverse effects**

nausea vomiting, diarrhea and abdominal pain

#### **Precautions**

Should be used in caution in patients with cardiac, renal and GI disease and elderly patients.

Dosage: - oral for acute attack 1.2mg initially followed by 1.2 mg every 2 hours until pain is relieved or until signs of GI toxicity appear.

### **Indomethacin**

NSAID used to treat Gout, its efficiency is equivalent to colichicine.

**Dosage:** 50mg initially followed by 25 mg doses 3-4 times a day.

### **Allopurinol**

Is used to reduce blood level of uric acid

It is indicated for primary hyperuricemia of gout and for hyperuricemia occurring secondary to cancer chemotherapy.

### **Action:-**

reduce uric acid level by inhibiting uric acid production

### **Indication-**

for chronic tophaceous gout.

### **Adverse effects:**

in rare cause's hypersensitivity syndrome, other mild effects include GI rxn (nausea, vomiting, diarrhea, abdominal pain), neuralgic effect (drowsiness, headache, metallic taste)

### **Contraindications and precautions**

Allergy

Use cautiously with liver disease, renal failure, pregnancy, lactation.

**Dosage:** - for treatment of chronic gout.

Initial dosage: 100mg once a day.

### ***Nursing responsibility***

Assess clients for hypersensitivity or allergic reaction

Determine HN of GI problem & HX of renal problem

Ascertain what other medication the client is taking

Discuss adherence to the drug regimen

Advise taking C meals or milk to decrease GI irritation

Inform the client about possible adverse rxn

Advise the client to report any symptom of GI irritation

Teach the client about the proper use of "OTC" dhy

## **1.11 Drugs act on respiratory system**

Respiratory agents is a term used to describe a wide variety of medicines used to relieve, treat, or prevent respiratory diseases such as asthma, chronic bronchitis, chronic obstructive pulmonary disease (COPD), or pneumonia. Respiratory agents are available in many different forms, such as oral tablets, oral liquids, injections or inhalations. Inhalations deliver the required medicine or medicines directly to the lungs, which means the medicine(s) can act directly on the lung tissues, minimizing systemic side effects.

### **Nasal Decongestants, Anti-tussives and related drugs**

#### **Nasal Decongestants**

Nasal congestion results from dilation and engorgement of blood vessels in the nasal mucosa.

Drugs can relieve congestion by causing  $\alpha$  mediated vasoconstriction Sympathomimetics reduce nasal congestion. How? by stimulation  $\alpha$ , adrenergic receptors on nasal blood vessels, which causes vasoconstriction, which in turn causes shrinkage of swollen membranes followed by nasal

drainage With topical administration vasoconstriction is both rapid and intense: with oral administration responses are delayed, moderate, and prolonged.

### List of drugs

**Topical phenylephrine** (nasal spray, nasal drop)

**Brand name:** Neo-Synephrine.

**Class of drug:** Sympathomimetic.

**Mechanism of action:** Phenylephrine constricts blood vessels by stimulation alpha, adrenergic receptors, resulting in increased total peripheral resistance, increased BP.

**Indications/dosage/route:** IV, IM, topical (ophthalmic).

- Hypotensive emergencies during spinal anesthesia

Adults: Initial: IV 0.1–0.2 mg.

Children: 0.5–1 mg/25 lb body wt.

- Mild to moderate hypotension

Adults: SC or IM 1–2 mg. Additional doses may be administered in 1–2 hours.

- Severe hypotension or shock

Adults: IV infusion 0.1–0.18 µg/min. Maintenance: 0.04–0.06 µg/min. prn.

- Midriasis

Adults: 1–2 drops 2.5 or 10% solution before procedure. May be repeated in 10–60 minutes if needed.

- Conjunctival congestion

Adults: 1–2 drops 0.08 to 0.25% solution in conjunctivae q3–4h prn.

**Food:** Not applicable.

**Pregnancy:** Category C.

**Lactation:** No data available. Potentially toxic to fetus. Avoid breastfeeding.

**Contraindications:** Severe hypertension, ventricular tachycardia and other ventricular tachyarrhythmias, hypersensitivity to phenylephrine or bisulfites (parenteral), camphor, eucalyptol, thimerosal in ophthalmic preparations. Ophthalmic preparations contraindicated in patients with angle-closure glaucoma and those who are wearing soft contact lenses.

**Warnings/precautions:** Use with caution in patients with hyperthyroidism, cardiac disease, diabetes (type I), hypertension, bradycardia, elderly.

### **Advice to patient**

- Ophthalmic preparations may make eyes more sensitive to light. If this occurs, wear dark glasses.
- Correct any hypovolemic state before phenylephrine is administered.
- Phenylephrine solutions exposed to air or strong light may no longer be effective. Store such solutions away from heat, light, and high humidity, ie, not in a bathroom medicine cabinet.
- Do not use solutions that have a brown color or contain a precipitate.

### **Adverse reactions**

- Common: headache, palpitations, burning, brow ache, photophobia.
- Serious: arrhythmias, MI, asthmatic attack, anaphylaxis.

### **Clinically important drug interactions**

- Drugs that increase effects/toxicity of phenylephrine: MAO inhibitors, ergonovine, general anesthetics, cardiac glycosides, levodopa, tricyclic antidepressants, oxytocics, ergot alkaloids.
- Drugs that decrease effects of phenylephrine:  $\alpha$ -adrenergic blockers, atropine.

### **Parameters to monitor**

- Monitor ECG continuously during IV administration for presence of arrhythmias.
- Signs and symptoms of side effects such as headache, dyspnea, pain, dizziness during IV infusion. Discontinue if these become serious.
- Monitor patient receiving ophthalmic preparation for signs of systemic effects: dizziness, chest pain. If this occurs, drug should be discontinued.
- Monitor BP, heart rate, arterial blood gases, and central venous pressure when administering IV.

### **Ephedrine**

**Brand name:** Ephedrine.

**Class of drug:** Adrenergic amine, bronchodilator, pressor agent.

**Mechanism of action:** Relaxes smooth muscles of the bronchioles by stimulating  $\beta_2$  adrenergic receptors.

**Indications/dosage/route:** Oral, IV, IM, SC.

Oral\_bronchodilation,\_nasal decongestion

Adults: 25–50 mg q3–4h.

Pediatric: 3 mg/kg/d in four to six divided doses.

- Bronchodilation

Adults: SC or IV 12.5–25 mg.

Pediatric: 3 mg/kg in 4 to 6 doses.

### Drugs for Asthma

Bronchial asthma is a chronic respiratory problem associated with reversible airflow obstruction .airway inflammation plays major role in the pathogenesis of asthma. Clinically it is characterized by episodic shortness of breath, wheezing and coughing. Common precipitation factors include exposure to cold weather, upper respiratory tract infections, bad smells, exercise, and ingestion of drugs like aspirin and beta- blockers such as propranolol

### List of drugs

Anti asthmatic drugs fall in to two main pharmacological classes: anti-inflammatory agents and bronchodilators. **Bronchodilators** include beta<sub>2</sub> agonists, parasymphatolytics and methyl xanthenes

- Beta2 agonists: Albuterol(salbutomal) salmeterol, Formeterolo , Terbutaline  
Adrenaline, Ephedrine
- Anticholinergics; Ipratropium
- Methylxanthines: Theophylline , Aminophylline

**Anti-inflammatory agents** include glucocorticoids and cromolyn.

**Glucocorticods:** Hydrocortisone, Belcomethasone , Prednisolone

Most anti asthmatic drugs can be administered by inhalation

Metered-dose inhalers (MDIs) small hand-held, pressurized devices that deliver a measured dose of drug with each activation.

### **Action:**

Glucocorticoids reduce symptoms of asthma by suppressing inflammation. Specific anti-inflammatory effects include: decreased synthesis and releases of inflammatory mediators, decreases infiltration and activity of inflammatory cells, decreased edema of the airway mucosa.

### **Adverse effects:**

With inhaled glucocorticoids: oropharyngeal candidiasis, dysphonia With oral glucocorticoids adrenal suppression, osteoporosis, hyperglycemia peptic ulcer, in young patients suppression of growth.

Note: Oral glucocorticoids are reserved for patients with severe asthma. Because of their potential for toxicity; these drugs are prescribed only when symptoms can not be controlled with safer medication such as beta2 agonists

### **Contraindications:**

Hypertension, systemic infection, diabetes, osteoporosis, users of live vaccine, in those receiving immunosuppressive therapy

### **Parameters to monitor**

- Serum electrolytes, glucose.
- BP. Check at least twice daily during period of dose adjustment.
- Signs and symptoms of hypokalemia: cardiac arrhythmias, flaccid paralysis, tetany, polydipsia.
- Periodic ophthalmoscopic examinations. Long-term use may cause cataracts, glaucoma, secondary fungal or viral infections.
- Signs of infection.
- Fluid and electrolyte balance. Check for salt and water retention.

Weigh patient on regular basis.

- Symptoms of peptic ulcer.

## **1.12 Drugs act on cardiovascular system**

The cardiovascular system is sometimes called the blood-vascular, or simply the circulatory, system. It consists of the heart, which is a muscular pumping device, and a closed system of vessels called arteries, veins, and capillaries. As the name implies, blood contained in



the circulatory system is pumped by the heart around a closed circle or circuit of vessels as it passes again and again through the various "circulations" of the body.

### **Cardiovascular drug,**

Any agent that affects the function of the heart and blood vessels. Drugs that act on the cardiovascular system are among the most widely used in medicine. Examples of disorders in which such drugs may be useful include hypertension (high blood pressure), angina pectoris (chest pain resulting from inadequate blood flow through the coronary arteries to the heart muscle), heart failure (inadequate output of the heart muscle in relation to the needs of the rest of the body), and arrhythmias (disturbances of cardiac rhythm).

### **Types of Heart Medications**

Anticoagulants

ACE Inhibitors

Angiotensin II Receptor Blockers

Beta Blockers

Calcium Channel Blockers

#### **Anticoagulants**

Anticoagulants are a group of medications that decrease your blood's ability to clot. They do that by letting the body break down existing clots or by preventing new clots from forming. anticoagulants come in many different forms, including injections, intravenous (IV) drugs, and medications to be taken by mouth

#### **Common side effect**

A possible side effect of anticoagulants is **excessive bleeding (haemorrhage)**, because these medicines increase the time it takes for blood clots to form

#### **Main types of anticoagulant medications:**

Vitamin K antagonists

Direct Oral Anticoagulants (DOACs)

Low molecular weight heparins (LMWH)

## **Angiotensin-converting enzyme inhibitor (ACE inhibitors)**

### **Mechanism of action**

ACE inhibitors work by interfering with the body's renin-angiotensin-aldosterone system (RAAS). RAAS is a complex system responsible for regulating the body's blood pressure. The kidneys release an enzyme called renin in response to low blood volume, low salt (sodium) levels or high potassium levels.

### **Common side effect**

**Side effects of ACE inhibitors may include:**

Dry cough;

Increased potassium levels **in** the blood (hyperkalemia);

Fatigue; Dizziness from blood pressure going .

Angiotensin-converting enzyme inhibitor (ACE inhibitors) drugs include

Benazepril (Lotensin),

Captopril (Capoten),

Enalapril/

Enalaprilat (Vasotec oral and injectable),

Fosinopril (Monopril),

Lisinopril (Zestril and Prinivil),

Moexipril (Univasc),

Perindopril (Aceon),

Quinapril (Accupril), Ramipril

### **Angiotensin II receptor blockers**

**Drugs under this class include**

Azilsartan (Edarbi)

Candesartan (Atacand)

Eprosartan.

Irbesartan (Avapro)

Losartan (Cozaar)

Olmesartan (Benicar)

Telmisartan (Micardis)

Valsartan (Diovan)

### **Action**

Reduce the action of the hormone angiotensin II. This hormone has a powerful constricting effect on blood vessels, increasing blood pressure. Angiotensin II also stimulates salt and water retention in the body, which further increases blood pressure

### **Common side effect**

Side effects of ARBs include: headache. fainting. dizziness.

### **Beta blockers**

Beta blockers, also known as beta-adrenergic blocking agents, are medications that reduce blood pressure.

### **Action**

Beta blockers work by blocking the effects of the hormone epinephrine, also known as adrenaline. Beta blockers cause the heart to beat more slowly and with less force, which lowers blood pressure.

### **Side effect**

Side effects commonly reported by people taking beta blockers include:

**feeling tired, dizzy or lightheaded** (these can be signs of a slow heart rate)

cold fingers or toes (beta blockers may affect the blood supply to your hands and feet)

difficulties sleeping or nightmares.

Drugs included under this class

Acebutolol (Sectral)

Atenolol (Tenormin)

Betaxolol (Kerlone)

Bisoprolol (Zebeta, Ziac)

Carteolol (Cartrol)

Carvedilol (Coreg)

Labetalol (Normodyne, Trandate)

Metoprolol (Lopressor, Toprol-XL)

### **Calcium channel blockers**

Calcium channel blockers are a group of medications that limit how . the body uses calcium

#### **Action**

They work by preventing **calcium** from entering the cells of the heart and arteries.

. By slowing down how your cells use calcium, these medications can lower your blood pressure, prevent heart rhythm problems

#### **Side effect**

Side effects of calcium channel blockers can include: Lightheadedness. Low blood pressure.

Slower heart rate

### **Drugs under this class**

Calcium channel blocking agents are generally classified into three groups according to their chemical structure:

benzothiazepines (diltiazem);

phenylalkylamines (verapamil);

dihydropyridines (amlodipine, bepridil, felodipine, isradipine, nicardipine, nifedipine, and nisoldipine).

**Digoxin (Lanoxin)** is the most commonly used cardiotonic drug. Other terms used to identify the cardiotonics are cardiac glycosides or digitalis glycosides.

Increase the force of myocardial contractility eg: - cardiac glycosides

Digoxin is a positive inotropic and negative chronotropic drug<sup>7</sup>, meaning that it increases the force of the heartbeat and decreases the heart rate

### **Vasodilators**

Examples Enalapril, captopril

#### **Action**

By inhibiting angiotensin converting enzyme suppress production of angiotensin II, there by dilates arterioles & veins and release of aldosteron. These actions have the following effects

Arteriole dilation improves blood flow by reducing after load.

Venodilation: decreases venous pressure, Pulmonary congestion, peripheral edema & cardiac dilation

By dilating renal blood vessels: increase RBF

Suppression of aldosterone synthesis: removes  $\text{Na}^+$  i.e. Diuresis.

### 1.13 Drugs act on the renal system

**Renal system**, an organ system that includes the **kidneys**, where **urine** is produced, and the **ureters**, **bladder**, and **urethra** for the passage, storage, and voiding of urine.

#### Diuretics

Diuretics are drugs, which increase renal excretion of salt ( $\text{NaCl}$ ) and water.

These agents have two major applications:-

- ♣ treatment of hypertension
- ♣ Mobilization of edematous fluid (associated with heart failure, liver cirrhosis and kidney disease).
- ♣ In addition, b/s of their ability to maintain urine flow, diuretics are used to prevent renal failure.

Their primary effects is to decrease the reabsorption of  $\text{Na}$  and  $\text{Cl}$  from the glomerular filtrate, increased water loss being secondary to the increased excretion of  $\text{NaCl}$

There are four major categories of diuretics

- High- Ceiling (loop)diuretics
- thiazide diuretics
- potassium sparing diuretics
- Osmotic diuretics.

#### High ceiling (1oop) Diuretics

Examples: Furosemide (Lasix) Bumetanide

Toresemide Etacrynic acid

Loop diuretics act on the thick segment of the ascending loop of Henley; they inhibit the reabsorption of  $\text{NaCl}$  by blocking the  $\text{Na}^+/\text{K}^+/\text{2Cl}^-$  carrier in the luminal membrane.

Loop diuretics are the most powerful of all diuretics, Capable of causing 15-25% of Na in the filtrate to be excreted , that is why they are termed as high ceiling diuretics.

#### Indications:

Generally the Use of loop diuretics should be reserved for situations that require rapid or massive mobilization of fluid such as:

- Pulmonary edema associated with congestive heart failure (oral, iv).
- Edema of hepatic, cardiac or renal or other organ Origin (oral, iv).
- Acute pulmonary edema (iv).
- Hypertension (thiazide diuretics are preferred) but loop diuretics can be indicated in cases of sever hypertension which is associated with renal failure, heart failure, or liver cirrhosis (oral).

#### Adverse effects:

- Related to their renal action: hypokalemia(can be managed by concomitant use of k<sup>+</sup> - sparing diuretics or by K<sup>+</sup> Supplement), metabolic alkalosis,hypomagnesemia, hypernatremia, dehydration, hypochloremia
- Other effects: Nausea, anorexia, weakness, Ortostatic hypotension muscle cramps, dizziness, ototoxicity.

#### Drug interactions

- The risk of hearing impairment can increase with other ototxic drugs such as aminoglycoside antibiotics.
- Increased risk of cardiac arrhythmias with cardiac glycosides, so potassium supplement is essential.

#### Contraindications/cautions:

- Pregnancy, allergy, electrolyte depletion, sever renal failure, lactation
- Precautions: gout, diabetes mellitus.

#### Thiazide diuretics

Examples     Hydrochlorothiazide  
                  Chlortalidone

Thiazide diuretics act by inhibiting the  $\text{Na}^+/\text{Cl}^-$  Co-transporter in the distal convoluted tubule. They have also extra renal action i.e. they can cause vasodilatation and thereby decrease arteriolar resistance; moreover, thiazide diuretics have a paradoxical effect in diabetic insipidus, where they decrease the volume of urine.

Hydrochlorothiazide is first drug of choice for hypertension due to reduction of Bp by two mechanisms:

- Reduction of blood volume
- Reduction of arteriolar resistance.

#### **Indications:**

- Hypertension
- mild heart failure(loop diuretics are usually needed),
- Edema of hepatic, renal and cardiac origin.
- diabetic insipidus

**Note:** Thiazide diuretics are ineffective when GFR is  $< 15 - 20$  ml/min.

#### **Adverse effects:**

- Hyponatremia, hypokalemia, metabolic alkalosis, increased plasma uric acid, hyperglycemia, and increase in plasma cholesterol.

#### **Contraindications:**

- Gouty arthritis, diabetic mellitus, dyslipidemia, severe renal impairment.

#### **Potassium sparing Diuretics**

Examples: Spironolactone Amiloride  
: Triamterene

Potassium sparing diuretics are mild diuretics causing diuresis by increasing the excretion of  $\text{Na}^+$ , but decreases the excretion of  $\text{K}^+$

They act by disrupting  $\text{Na}^+/\text{K}^+$  exchange in the late distal convoluted tubule and collection duct, triamterene and amiloride are direct inhibitors of the transporter, while spironolactone is aldosterone receptor blocker.

### Indications:

- To counteract K wasting (With loop and thiazidediuretils)
- Hypertension and edema .

### Adverse effects:

- Hyperkalemia, metabolic acidosis, dizziness, headache, drowsiness, fatigue, hyponatremia, with spironolactone; irregular menses, amenorrhea.

### Drug interactions

- Increased hyperkalemia with potassium supplements, diets rich in potassium
- Decreased diuretic effect with salicylates.

### Osmotic Diuretics

Examples: Mannitol Glycerin  
Urea Isosorbide

Osmotic diuretics undergo minimal reabsorption after filtration and this creates an osmotic force within the lumen of the nephron, this intern prevents passive reabsorption of water.

### Indications:

- Prophylaxis of renal failure.
- To reduce intracranial pressure.
- To decrease intraocular pressure (glaucoma).

### Nursing Responsibility

- Protect the client from exertion
- Help client ambulate, take sefty measures to prevent falls
- Teach clients & families how to manage the drug regimen at home
- Monitor regularly the status of cliants brhg treated
- Reassure clients that some adverse rxn are self limited
- Establish good nurse – client relation ship
- Reassurance & emotional support.
- Carefully assess the client’s flurd & electrolyt status



## 1.14 Drugs act on endocrine system

**Definition of endocrine system :** The glands and organs that make hormones and release them directly into the blood so they can travel to tissues and organs all over the body

### Antidiabetic Drugs

- Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.
- The chronic hyperglycemia of diabetes is associated with long term damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves heart and blood vessels.
- There are two principle forms of diabetes: type 1 diabetes and type 2 diabetes.
- The cause for type1 DM is an absolute deficiency of insulin secretion, there is destruction of pancreatic  $\beta$ -cells which are responsible for insulin secretion. B-cell destruction is as a result of an autoimmune process.
- The cause for type 2 diabetes is a combination of resistance to insulin action and an inadequate compensatory insulin secretory response.

**List of drugs;**      Insulin

Oral hypoglycemic agents

Tolbutamide      Glibenclamide      Metformin      Glipizide

### Insulin

- Insulin is available in several forms, differ with respect to time course of action, route of administration and source.
- Insulin is given by injection, b/s of its peptide structure, would be inactivated by digestive enzymes if it were given by mouth
- Regular (natural insulin): is unmodified crystalline form of insulin, has relatively rapid onset and short duration of action, dispensed as a clear solution and is the only form of insulin that can be administered iv(if and only if in emergency), however, the usual route of administration is sc.

- Lispro insulin and insulin aspartate: rapid acting analogs of regular insulin thus can be administered immediately before eating.
- Neutral protamine hagedron(NPH) insulin: prepared by conjugation regular insulin with protamine (a large protein) ,intermediate acting form.
- Lente insulin: prepared by conjugation regular insulin with zinc,has intermediate action.

### Indications:

- Type 1 DM some patients with type2 Dm, IV insulin is used to treat diabetic ketoacidosis, to treat severe hyperkalemia.

### Adverse effects:

- Hypoglycemia(blood glucose level < 50 mg/dl) occurs when insulin levels exceed insulin needs
- Lipodystrophies(Altered deposition of subcutaneous fat)
- Allergic reactions

### Oral Hypoglycemic Agents

- These are only indicated for type 2 DM.

#### Tolbutamide

##### Action:

- Tolbutamide acts primarily by stimulating the release of insulin from pancreatic islets. If the pancreas is incapable of insulin synthesis, tolbutamide will be ineffective- which is why tolbutamide is ineffective in type 1 DM.

Adverse effects: Hypoglycemia, Cardiovascular toxicity

DDI: with alcohol disulfuram like reaction may occur

#### Glibenclamide

- Structurally similar to tolbutamide, also MOA is similar to tolbutamide.
- A/E Hypoglycemia
- DDI: with alcohol disulfuram like reaction may occur

- C/n Hepatic impairment, renal insufficiency
- Dosage: 2.5-20mg, p.o daily or divided into two doses, with the morning and evening meals.

## Metformin

Action:

- Lowers blood glucose primarily by decreasing production of glucose in the liver, the underlying mechanism appears to be suppression of gluconeogenesis. In addition the drug enhances glucose uptake and utilization by muscles.

Since the drug does not stimulate appetite (even it suppress) consequently useful in the majority of type 2 patients who are obese.

Adverse effects

- Anorexia, nausea, vomiting, abdominal discomfort and diarrhea.
- By inhibiting mitochondrial oxidation of lactic acid, it causes lactic acidosis.

Contraindications:

- renal disease, hepatic disease, alcoholism

Dosage: 500 - 2000mg p.o daily in divide doses.

## Drugs for thyroid disorders

### Thyroid Disorders

#### Hypothyroidism

A decreased activity in thyroid results in hypothyroidism, in severe cases myxedema ( in adults) results. Manifestations include: low metabolic rates, slow speech, weakness bradycardia, sensitivity to cold and mental impairment. Hypothyroidism can be caused by chronic autoimmune tyroiditis (hashimoto's disease), insufficient iodine in the diet, surgical removal of the thyroid, and destruction by radioactive iodine therapy. Sever hypothyroidism in infants is termed as cretinism.

## Drugs for hypothyroidism

### Levothyroxine (T<sub>4</sub>)

- A synthetic preparation of thyroxin ( T<sub>4</sub>), naturally occurring thyroid hormone.
- It is a drug of choice for patients who require thyroid hormone replacement.

#### Pharmacokinetics

- Much of an administered dose will be converted to T<sub>3</sub> in the body.
- It is highly protein bound, thus has long half- life and has delayed onset of action.

#### Clinical uses

- For all forms of hypothyroidism ,cretinism, myxedema coma, ordinary hypothyroidism in adults and children and simple goiter.
- Also use to treat hypothyroidism resulting from insufficient TSH and TRH.

#### Adverse effects

- With over dosage thyrotoxicosis may result: symptoms include: tachycardia, angina, tremor, nervousness, insomnia, hyperthermia, heat intolerance and sweating.

#### Drug- drug interactions

- Drugs that reduce levothyroxine absorption:cholestyramine, calcium supplements, sucalfate, iron supplements, aluminum antacids
- drugs that accelerate its metabolism, phenytoin, carbamazepine, rifampine, sertraline, Phenobarbital.
- Levothyroxine accelerates the degradation of vitamin K dependent clotting factors
- Levothyroxine increases cardiac response to catecholamines .

### Liothyronine(T<sub>3</sub>)

- A synthetic preparation of triiodothyronine ( T<sub>3</sub>), a naturally occurring thyroid hormone.
- As compared to levothyroxine, it has shorter half- life and duration of action, has rapid onset of action.
- It is preferred in situations that require speedy results, especially in myxedema coma.

## Hyperthyroidism

- There is excessive activity of thyroid hormones, resulting in high metabolic rate, an increase in skin temperature, sweating and marked sensitivity to heat, other manifestations include nervousness, tremor, tachycardia increased appetite associated with weight loss
- There are two major forms: graves disease (diffuse toxic goiter) and toxic nodular goiter.
- In addition to thyrotoxicosis, patients with grave's disease often present with exophthalmos ( protrusion of the eye ball)
- Grave's disease is caused by thyroid stimulating immunoglobulins.
- Treatment strategies ( directed at decreasing production of hormones ) include
- Surgical removal of thyroid tissues .
- Destruction of thyroid tissues with radioactive iodine.
- suppression of thyroid hormone synthesis with antithyroid drugs .
- Toxic nodular goiter is the result of thyroid adenoma.

## Drugs for hyperthyroidism

### Thioureylenes

Examples    propylthiouracil        Methimazole  
                 Carbimazole

### Propylthiouracil

Inhibits thyroid hormone synthesis

### Mechanism of action

- Blocks thyroid hormone synthesis in two ways
  - ✓ Prevents the oxidation of iodide.
  - ✓ Prevents iodinated thyrosines from coupling .

Both effects result from inhibiting peroxidase

### Pharmacokinetics

- Rapidly absorbed following oral administration.
- Plasma half – life is short.
- Crosses placenta and breast milk.

### Therapeutic uses

- Given alone or as an adjunct to radiation therapy in the treatment of hyperthyroidism.

### Adverse effects

- Granulocytopenia, rash, headache, nausea, jaundice, pain in the joints.

### Radioactive Iodine ( $^{131}\text{I}$ )

Radioactive iodine (the isotope  $^{131}\text{I}$ ) is taken up and processed by the thyroid in the same way as stable iodine, after being incorporated in the thyroglobulin, it emits B- particles and gamma-rays.

The gamma-rays pass through the tissues, but the B- radiation has a very short range and exerts a cytotoxic action virtually restricted to the cells of the thyroid follicles resulting in significant destruction. Has a half life of 8 days, by 2 months its radio activity has effectively disappeared.

Hypothyroidism will eventually occur due to destruction of the cell contraindications: pregnancy and lactation.

### Non-radioactive Iodine

Lugol's solution: 5% elemental iodine in 10% potassium iodide.

### Mechanism of action

- High concentration of iodide decrease iodine uptake by the thyroid.
- High concentration of iodide inhibits hormone synthesis by suppressing iodination and coupling.
- High concentration of iodide decreases release of thyroid hormones

### Use

Can be given in hyperthyroid individuals to suppress thyroid function in preparation for thyroidectomy

- In thyrotoxic crisis.
- As an antiseptic.

### Contraceptives

Contraceptives include different kinds of methods used to prevent the occurrence of pregnancy.

Methods of contraception include: Natural methods, intrauterine contraceptive devices, barrier methods, hormonal methods and permanent methods of contraception.

## **Hormonal contraceptives**

### **1- Oral contraceptives**

There are two main categories of oral contraceptives: combined oral contraceptives that contain both estrogen and progestin and those that contain only a progestin, known as "min-pills" or progestin only contraceptives

#### **Combined oral contraceptives (COCs)**

A group of contraceptives medications composed of synthetic estrogens and progesterone in different doses; 20µg or 50µg of estrogen and 0.15 - 1mg of progesterone in each tablet

#### **Examples:**

- Levonorgestrel + Ethinylestradiol+ Iron 0.15mg+0.03mg, 0.25mg+0.05mg+0.5mg, 0.3mg+0.03mg.
- Norethindrone +ethnylestradiol: 0.5mg+0.035mg.
- Norethindrone + menstranol + Iron: 1mg+0.05mg.

#### **Action:**

- Estrogen inhibits secretion of FSH - Suppresses development of ovarian follicle
- Progesterone inhibits secretion of LH - Prevent ovulation and promote thickening of cervical mucous, this hinders flow of sperm cell.
- Estrogen + progesterone- alter the endometrium in such away as to discourage fertilization and implantation.

None-contraceptive benefits: premenstrual syndrome, fibrocystic breast disease, anaemia, acne.

#### **Adverse effects**

- Thromboembolic disorders( by estrogen componet ) GI disturbance, glucose intolerance, loss of libido.

#### **Drug interactions:**

- Drugs that decrease effectiveness of contraceptives: Rifampine, antiepileptic drugs, antibiotics such as TTC, ampicillin.

Dosage: one tablet/day starting from the first day of menses.

#### **Contraindications**

- Pregnancy, genital tract malignancies, cardiovascular disease, hepatic disease

### **Progesterone only contraceptives (POs)**

Example: Lynestrenol, 0.5 mg

Indicated in case of estrogen contraindications as in lactating mothers, diabetics, hypertensive

#### **Adverse effects**

- Irregular vaginal bleeding, headache, mood change, weight changes, acne, .

#### **Contraindications**

- Pregnancy, cardiac illness, thrombo-embolic conditions, genital tract malignancies, hepatic dysfunction, migraine head ache

### **Long acting contraceptives (Injectables)**

#### **Depot medroxyprogesterone Acetate [Depo-Provera]**

Depo-Provera prevents pregnancy in three ways: Suppression of ovulation, thickening of the cervical mucus, and alteration of the endometrium such that nidation is discouraged.

Adverse effects: the same as in the POCs ,delay in return of fertility.

Dosage: 150mg deep Im injection with in the first 5 days of the cycle to be repeated every three months.

#### **Levonorgestrel Implants [Norplant]**

A sub-dermal system [Norplant system] for delivery of levonorgestrel is available for long- term reversible contraception

The Norplant system consists of six tiny silastic rubber capsules each containing 36 mg of levonorgestrel, under local anesthesia, the capsules are surgically implanted on the inside of the upper arm effective up to five years.

Adverse effects: the same as in the POCs, delay in return of fertility.

### **3. Emergency contraception (EC)**

Emergency contraception is aimed at preventing pregnancy after unplanned sexual exposure in a woman who is not on regular contraception.

COC with 50 µg of estrogen 2 tablets 12 hrly or COC with 35 µg of estrogen 4 tablets 12 hrly within 72 hrs of unplanned sexual exposure for two doses.

Adverse effects nausea, vomiting, menstrual disturbance

Contraindications: As in COC, POC

- Alternative: IUD insertion within 5 days after ruling out the existence of infection.



## Uterine Stimulants and Relaxants

### Uterine Relaxants (Tocolytics)

Examples: magnesium sulfate, nifedipine, Terbutaline,

These agents are used to suppress pre-term labor and thereby delay delivery.

### Magnesium sulfate

- It is a drug of choice for suppressing preterm labor

Action:

- It inhibits Ach release at Uterine neuromuscular junctions.

Adverse effects

- Muscle weakness.

Dosage: An initial i.v bolus (4-6 gm) followed by i.v infusion 2-3 gm/hr for 48-72 hrs

### Uterine stimulants (Oxytocics)

Examples: Oxytocin

Ergot alkaloids (Ergometern)

Prostaglandins

### Oxytocin

- Oxytocin promotes uterine contraction during parturition and stimulates the milk ejection reflex

Physiological and pharmacological effects

- Uterine stimulation:- can increase the force, frequency and duration of uterine contraction
- Milk ejection
- Water retention: by its similarity with antidiuretic hormone which acts on kidney to decrease excretion of water.

### *Use for indication of labor*

Induction of labor with oxytocin is reserved for

- Pregnancy that has continued beyond term
- Pregnancy in which early vaginal delivery is likely to decrease morbidity and mortality for the mother or infant.

- Induction should not be done if the fetal lungs have not yet matured or if the cervix is not yet ripe.

#### Precautions and contraindications

- Improper use of oxytocin may result in uterine rupture and leads to death to the mother as well as the infant.
- Thus, in presence of fetal malpresentation, placental abnormalities, umbilical prolapse, previous uterine surgery, and fetal distress the likelihood of trauma is high also it is contraindicated in a woman with active genital herpes.

#### A/E water intoxication

#### Dosage and administration

- for induction of labor oxytocin is administered by i.v. infusion
- Initial rate 1-2mu/min the infusion rate is then gradually increases (by 1-2 mu)/min every 30-60 min) until uterine contraction resembling those of spontaneous labor has been produced (Contractions every 2-3 minutes and lasting 45-60 seconds).

## 1.15 Drugs act on the nervous system

### Overview

Drugs acting in the central nervous system (CNS) were among the first to be discovered by primitive humans and are still the most widely used group of pharmacologic agents\*. These include medications used to treat a wide range of neurologic and psychiatric conditions as well as drugs that relieve pain, suppress nausea, and reduce fever, among other symptoms

Drugs for Parkinson's disease. Parkinson's disease (PD) is a neurodegenerative disorder; primary symptoms are tremor, postural instability and Rigidity slowed movement

Drugs

Levodopa	Entacapone	Levodopa plus carbidopa	Selegiline
Bromocriptine	Amantadine	Pergolide	Tolcapone

Antiepileptic Drugs

Epilepsy refers to a group of disorders characterized by excessive excitability of neurons within CNS, the abnormal neuronal activity can produce a variety of symptoms ranging from a brief periods of unconsciousness to violent convulsions.

Antiepileptic drugs act by two general mechanisms

By suppressing discharge of neurons within a seizure focus.

Suppressing Propagation of seizure activity from the focus to other areas of the brain.

List of drugs

Penobarbitone	Ethosuximide
Phenytoin	Valproic Acid (sodium valproate)
Carbamazepine	

Antidepressant Drugs

Depression is disorder of CNS characterized by mood and loss of pleasure or interest in one's usual activities and pastimes.

## 1.16 Drugs act on the musculoskeletal system

Centrally acting muscle relaxants have a selective action on the central nervous system and are used in the management of spasticity due to neuromuscular and musculoskeletal disorders and for relief of painful muscle spasm

Examples include Diazepam and baclofen

Are effective for the control of muscle spasm in a variety of disorders

Dantrolene sodium

Indications: treatment of spasticity associated with spinal cord injury, stroke, cerebral palsy, or multiple sclerosis; treatment of malignant hyperthermia.

Contraindications: active hepatic disease; should not be used where spasticity is used to maintain posture or balance.

Side effects: drowsiness, dizziness, lightheadedness, fatigue, rash, diarrhea, vomiting, muscle weakness, chills, fever, headache, insomnia, nervousness, mental depression, constipation, anorexia, stomach cramps, blurred vision, respiratory depression.

Dose and Administration: Oral:

Spasticity:

Adult: 25mg/day to start, increase frequency to 2 - 4 times/day, then increase dose by 25mg every 4 - 7 days to a maximum of 100mg 2 - 4 times / day or 400mg/day.

Child: initial 0.5mg/kg/dose twice daily, increase frequency to 3 - 4 times/day at 4 - 7 day intervals, then increase dose by 0.5mg/kg to a maximum of 3mg/kg /dose 2 - 4 times/day up to 400mg/day.

Diazepam

Indications: muscle spasm of varied etiology, including tetanus; Cautions: see section 4.2;

Dose and Administration:

Oral: 2 - 15 mg daily in divided doses, increased if necessary in spastic conditions to 60 mg daily according to response.

Cerebral spasticity in selected cases: Child: 2 - 40 mg daily in divided doses.

## 1.7 Drug that act on integumentary system

Common drugs

Anti-infective

Definition :Anti-infectives is a general term used to describe any medicine that is capable of inhibiting the spread of an infectious organism or by killing the infectious organism outright. This term encompasses antibiotics, antifungals, anthelmintics, antimalarials, antiprotozoals, antituberculosis agents, and antivirals.

Benzoic Acid + Salicylic Acid (White field's Ointment)

Indications: fungal infections of the skin.

Side effects: skin irritation and dryness may occur.

Dose and Administration: Topical, to the skin for several weeks until the infected stratum is shed. Prolonged use should be avoided and irritation of the skin occurs.

Castellani's paint (Magenta + Boric Acid + Phenol + Resorcinol + Alcohol  
90 % + Acetone)

Indications: superficial fungal infections of the skin including tinea pedis and ringworm infections.

Dose and Administration:

The skin should be cleansed with soap and water and thoroughly dried prior to application.

It is usually applied once or twice daily, however, application of the drug

3 times daily may be necessary in chronic or stubborn infections.

Clotrimazole

Indications: cutaneous candidiasis

tinea corporis      tinea cruris      tinea pedis

Side effects: hypersensitivity (skin rash, hives, blistering, burning, itching peeling, redness, stinging, swelling and other sign of skin irritation not present before therapy).

Dose and Administration: Adult and Child: topical, to the skin and surrounding area, two times a day, morning and evening.

Sodium thiosulphate

Soln 15%

Gentian Violet

Solution, 0.5 %, 1 %

Indications: for the treatment of skin infections caused by candida and bacteria, and genital candidiasis.

Side effects: skin or genital irritation It also stains skin and clothing.

Dose and Administration: Topical, to the skin. Do not cover the affected area with dressings after application.

Apply every 8 – 12 hours daily for about 3 days.

Ketoconazole

Indications: fungal skin infections.

Side effects: itching, stinging, or irritation not present before therapy for cream and shampoo; contact dermatitis for cream.

Note – Ketoconazole 2 % cream is intended for topical application to the skin only and should not be applied to the eye nor administered intra vaginally.

Dose and Administration:

Ketoconazole cream

Adult: Topical to the affected skin and surrounding area.

Tinea corporis or Tinea cruris, Tinea pedis or Pityriasis versicolor: once a day.

Candidiasis, cutaneous: once a day. More resistant cases may require twice a day treatment.

Seborrheic dermatitis: two times a day.

Paronychia or Tinea barbae or Tinea capitis: two or three times a day.

Safety and efficacy have not been established for pediatric use.

### **1.18 Drug that act on EENT system**

Ophthalmic Drugs

Miscellaneous ophthalmic Drugs

Anti -infectives

chloramphenicol(ointment, eye drop/solution)

Erythromycin (eye ointment)

Gentamicin (eye ointment)

Neomycin(eye ointment)  
Oxytetracycline (eye ointment)  
Silver nitrate (eye drop)  
Tetracycline (eye ointment, solution)  
Antinflammatoriory (glucocorticoids)  
Hydrocortisone  
Local anaesthetics  
Benoxinate Hcl  
Bupuvacaine, procaine, tetracaine.  
Antiallergics  
Sodium cromoglyate (mast cell stabilizer)  
Oxymetazoline (ocular decongestant or vasoconstrictor)  
Tetrahydrozoline (ocular decongestant or vasoconstrictor)  
Corneal dehydrating agents - To treat edema of the cornea  
Hypertonic sodium chloride  
Anhydrous glycerin  
Wetting agents -Isotonic solutions for the replacement of tears to prevent dryness of conjunctiva.

### **1.19 Chemotherapy of infectious diseases**

Infectious diseases are the diseases caused by various pathogenic microorganisms such as virus, bacteria, protozoan, fungi, and other parasites. These infectious diseases can be transmitted by animals, humans, insects or other agents

#### **Terminologies**

##### **Chemotherapy**

Refers to the use of drugs for the treatment of infection and cancer

##### **Antibiotics**

Are substances produced by same microorganisms that kill or inhibit the growth of other micro-organisms.

##### **Antimicrobials**

Are any agents, either natural or synthetic that have the ability to kill or suppress the growth of micro-organisms.

### **Broad spectrum agents**

Active against gram-positive gram-negative and other bacteria

I.e. active against a wide range of bacterial species

### **Narrow spectrum agents**

Active against specific group of microbes within gram-positive or gram-negative

### **Bacteriostatics**

Agents that inhibit the growth of, but does not kill the bacteria

### **Bactericidals**

Agents that mediate killing of bacteria

Chemotherapeutic agents are toxic to the pathogenic microbe without causing any injury to the host cell.

How antimicrobials are selectively toxic to the pathogen?

The biochemical differences b/n microbes and mammalian cells contributes for the selective toxicity of antimicrobials i.e. drugs that interfere with unique microbial processes can cause serious injury to the micro-organisms while leaving the mammalian cells intact.

Some of the biochemical differences that contributes to antimicrobial activity

Disruption of bacterial cell wall e.g. penicillins

Inhibition of an enzyme ( a metabolic pathway) unique to bacteria e.g. inhibition of dihydropterate syntheses by sulfonamides.

Disruption of bacterial protein synthesis b/s of the difference in ribosomal sub-unit. e.g tetracyclines

### **Antimicrobial Drug Resistance**

Overtime, an organism that had once been highly responsive to an antibiotic may become less susceptible, or it may lose sensitivity to the drug entirely. Acquired resistance is of great concern in that it can render currently effective drugs useless, thereby creating a clinical crisis and constant need for new antimicrobial agents.

### **Prevention of antimicrobial Resistance**

To prevent or delay the occurrence of antimicrobial drug resistance the following points are important

Prevent infection.

Diagnose and treat infection effectively

Use antimicrobials wisely

Prevent transmission.

### **Choice of Antimicrobial Agent**



A number of factors influence the choice of the antimicrobial agent for the treatment of infection when choosing an antibiotic three principal factors must be considered.

- (i) The identity of the infecting organism.
- (ii) Drug sensitivity of the infecting organism.
- (iii) Host factors such as age, sex, disease condition, host defence mechanisms and etc.

### **Therapy with Antibiotic Combination**

Therapy with combination of antibiotics is indicated only in specific situations.

When two antibiotics are used together, the result may be additive, synergistic or antagonistic.

Antagonistic effect can occur when a bacteriostatic drug is combined with bactericidal drug (why?).

Indications for antibiotic combination

Initial therapy of sever infection of unknown etiology

Mixed infections.

For Prevention of resistance (e.g.TB)

To decrease toxicity???

To have enhanced antibacterial activity

Disadvantages of antibiotic combination

Increased risk of toxic and allergic reactions.

Possible antagonism of antimicrobial effect.

Increased risk of suprainfection.

Selection of drug resistance bacteria.

Increased cost.

### **Prophylactic Use of Antimicrobial Drugs**

Agents are given to prevent infection in certain situations such as:

Surgery

Bacterial endocarditis

Neutropenia

### **Misuse of Antimicrobial Drugs**

Some common misuses include:

Attempted treatment of untreatable infection.

Treatment of fever of unknown etiology.

Improper dosage.

Treatment in the absence of adequate bacteriologic information.

Omission of surgical drainage.

### **Classification of anti microbial**

Based on susceptible micro organism

Broad spectrum

Narrow spectrum

Extended spectrum

Based on mechanism of action

Drug that inhibit bacterial cell wall synthesis

Penicillin, cephalosporin , vancomycin

Drug that inhibit bacterial protein synthesis

Bacterio static

Tetracycline

Chloramphenicol

Clindamycin

Macrolid antibiotic

Erythromycin

Clarithromycin

Azetromycin

Bacterio cidal

Amino glycosides

Gentamycin

Streptomycin

Neomycin

Kanamycin

Drug that inhibit bacterial nucleic acid synthesis

Qunolone

Ciprofloxacin

Norfloxacin

Ofloxacin

Drug act as anti metabolites

Sulfonamide

Trimetoprim

Co-trimoxazol

Antibiotics

Antibiotics are medicines that fight infections caused by bacteria in humans and animals by either killing the bacteria or making it difficult for the bacteria to grow and multiply. Bacteria are germs. They live in the environment and all over the inside and outside of our bodies.

### List of Antibiotic Classes (Types of Antibiotics)

Penicillins.

Tetracyclines.

Cephalosporins.

Quinolones.

Lincomycins.

Macrolides.

Sulfonamides.

Glycopeptides.

### Common Side Effects of Antibiotics

Mild skin rash or other allergic reactions · Soft stools, short-term diarrhea · Upset

### Types of penicillin's

#### 1- Narrow spectrum penicillin's

These are inactivated by B- lactamase or they are ineffective in B- lactamase producing bacteria.

Examples of drugs:

Benzylpenicillin (penicillinG)

Phenoxymethyl penicillin (penicillinV)

#### 2- Ant staphylococcal penicillin's

These agents are not inactivated B- lactamase enzyme produced by staphylococci and thus they are used in infections caused by staphylococci which produce B-lactamase

Examples;

Nafcillin

Cloxacillin

Flucloxacillin

Dicloxacillin

#### 3- Broad - spectrum penicillin's

These have the same antimicrobial spectrum as penicillinG plus increasing activity against it certain gram-negative bacilli.

Example;

Ampicillin      Amoxicillin      Bacampicillin

#### **4- Extended – spectrum penicillin's (Antipseudomonal penicillins)**

The antimicrobial spectrum of these drugs includes organisms that are susceptible To the brood – spectrum penicillin's plus pseudomonas aerogenosa.

Example;

Carbencilline      Mezlocillin      Piperacillin      Ticarcillin

#### **Narralls- spectrum penicillin's**

##### **Penicillin G (Benzyl pencillin)**

Penicillin G is active against most gram positive cocci and bacilli (except B-lactamase producing staphylococci) gram-negative cocci (*Neisseria meningtidis* and non-penicillin's producing *Neisseria gonorrhea*, anaerobic bacteria and spirochetes such as *Treponema palladium*

##### **Cephalosporins**

- Cephalosporin's are similar in structure and action as penicillin's.
- They have the same mechanism of action as penicillin's
- Cephalosporin's are classified in to three generations based on the order of their introduction in to clinical use.

##### **First Generation Cephalosporin's**

Examples:

Cefazolin

Cephalexin

Cepharadin

Cefadroxil

Cephapirin

These agents are highly active against gram –positive bacteria.

They are the most active of all cephalosporins against staphylococci and non- enterococcal streptococci.

## Second Generation Cephalosporin's

Examples:

Cefaclor      Cefuroxime      Cefametzole      Cefprozil      Cefoxitin

-As compared to first generation agents they have enhanced activity against gram-negative bacteria.

However, none of them is active against *pseudomonas aeruginosa*

- Cefuroxime is the prototype drug among the class.

## Third Generation Cephalosporin's

Examples

Ceftriaxone      ceftazidime      cefotaxime

Third generation cephalosporin's have a broad spectrum antimicrobial activity.

Antiviral Drugs

I Drugs for non -HIV viral infections

Examples: Acyclovir      Amantadine  
Ganciclovir      Rimantidine

## Acyclovir

Acyclovir is the agent of first choice for most infections caused by herpes simplex virus and varicella-zoster viruses

### Action

Acyclovir inhibits viral replication by suppressing synthesis of viral DNA.

### Indications

Herpes simplex genitalis

Mucocutaneous herpes simplex infection.

Varicella zoster infections

### Adverse effects:

with I.V therapy phlebitis and inflammation at the site of infusion; reversible nephrotoxicity (can be minimized by slow i.v infusion and ensuring adequate hydration during the infusion and for 2 hours after).

with oral therapy: nausea, vomiting, diarrhea, headache and vertigo;

With topical acyclovir transient burning or stinging sensations.

### Contraindications

Allergy to acyclovir, seizures, renal disease, lactation, CHF.

## Dosage

### Oral

For initial episodes of herpesgenitalis, acyclovir, 400mg tid for 7-10 days

For long term suppressive therapy of recurrent genital infections;

acyclovir, 400mg bid for up to 12 months

For episodic recurrences of herpes genitalis: acyclovir, 400mg, tid for 5 days.

For acute therapy of herpes zositer, 800mg, 5 times a day (at 4hrs

Interval) for 7-10 days

- For varicella (chickenpox) 20mg/kg (but not > 800mg qid, for 5 days).

### Intravenous

For mucocutaneous herpes simplex infection in the immunocompromised host:

5mg/kg infused every 8 hours for 7 days

For varicella - zositer infection in the immunocompromised host iv infused every

8 hours for 7 days

-For sever episodes of herpes genitalis in the immunocompetent host 5- 10mg/kg

infused every 8 hours for 5-7 days

### ii Drug for HIV infection

NRTI (niuclosid revers transcriptase inhibitor)

Lamivudin (3TC)

Stavudin (D4T)

Zidovudin (AZT)

Anti fungal

Are drug used for the treatment of fungal infection

Are classified

Anti fungal antibiotic

Ampotericine B

Nystatin

Grisofulvin

Synthetic anti fungal

Flusytocin

Azol

Imidazol

Ketoconazol

Miconazol

Clotrimazol

Triazol

Itraconazol

Fluconazol

## 1.19. Chemotherapy of infectious diseases

### Overview

Chemotherapy literally refers to the treatment of certain diseases using specific chemicals that are destructive to malignant cells or to the causative agent of a disease such as a bacteria or virus.

Infectious diseases Infectious diseases are disorders caused by organisms — such as bacteria, viruses, fungi or parasites

Pediculosides and Scabicides

Scabies is caused by infestation with *Sraccptes scabiei*, an organism known commonly as the itch mite.

Pediculosis refers to infestation with any of several kinds of lice; such as *Pediculos humanus capitis* (head louse), *Pediculos humanus corporis* (body louse), *Pathirus pubis* (pubic or crab louse)

Permethrin

Toxic to mites, lice, and their ovaries; also toxic against fleas and ticks.

The drug kills adult insects by disrupting nerve traffic, their by causing paralysis

Indications: for both pediculosis and scabies.

Adverse effect: pruritus, erythma.

Lindane

Absorbed through the chitin shell of adult mites and lice and cause death by inducing vomiting.

Indications: for both pediculosis and scabies.

Adverse effect: Irritation, convulsions.

Others

Benzyl benzoate -for both pediculosis and scabies.

Crotamiton- for scabies.

Malathion- for pediculosis.

Ivermectin- orally for both pediculosis and scabies.

#### Antihelminthic Drugs

Helminthes are parasitic worms, and anthelmintics are the drugs used against them.

The most common parasitic worms belong to three Classes: nematoda (round worms), cestoda (tapeworms) and trematoda (flukes).

The helminthic infestations are grouped into four categories:

Examples of drugs: mebendazole    Pyrantal

Albendazole    Praziquantel

Thiabendazole    Ivermectin

### 1.20 Cancer chemotherapy

Cancer is a disease in which there is uncontrolled multiplication and spread of the body's own cells.

A normal cell turns into a cancer cell because of one or more mutation in its DNA which can be inherited or acquired.

Cytotoxic agents

Alkylating agents

Antimetabolites

Antitumor antibiotics

Mitotic inhibitors etc



## 1.21 .Pregnancy drug category and classification

In 1979, the FDA established five letter risk categories - **A, B, C, D or X** - to indicate the potential of a drug to cause birth defects if used during pregnancy. The categories were determined by assessing the reliability of documentation and the risk to benefit ratio.

<u>Category</u>	<u>Definitions*</u>	<u>Clinical Application</u>
Category A	"Controlled studies in women fail to demonstrate a risk to the fetus in the first trimester (and there is no evidence of a risk in later trimester), and the possibility of fetal harm appears remote."	For all practical purposes, there are no Category A drugs.
Category B	"Either animal-reproduction studies have not demonstrated a fetal risk but there are no controlled studies in pregnant women or animal-reproduction studies have shown an adverse effect (other than a decrease in fertility) that was not confirmed in controlled studies in women in the first trimester (and there is no evidence of a risk in later trimesters)."	Category B drugs include prenatal vitamins, acetaminophen and several other medications used routinely and safely during pregnancy. If there is a clinical need for a Category B drug, it is considered safe to use it.
Category C	"Either studies in animals have revealed adverse effects on the fetus (teratogenic or embryocidal or other) and there are no controlled studies in women or studies in women and animals are not available. Drugs should be given only if the potential benefit justifies the potential risk to the fetus."	Category C drugs have <u>not</u> been shown to be harmful to fetuses (if they had been, they wouldn't be Category C drugs). However, there are some reasons to be more concerned about these

		drugs than Category B drugs. If the pregnant patient will benefit from a Category C drug, it is generally used, although most obstetricians would prefer a Category B drug if it will give equivalently good results.
Category D	"There is positive evidence of human fetal risk, but the benefits from use in pregnant women may be acceptable despite the risk (e.g., if the drug is needed in a life-threatening situation or for a serious disease for which safer drugs cannot be used or are ineffective.)"	Category D drugs have some significant risks. They should be used during pregnancy only when the alternatives are worse.
Category X	"Studies in animals or human beings have demonstrated fetal abnormalities or there is evidence of fetal risk based on human experience or both, and the risk of the use of the drug in pregnant women clearly outweighs any possible benefit. The drug is contraindicated in women who are or may become pregnant."	Category X drugs should not be u

**Table 1. Pregnancy drug category**

## 1.22 Fluids and minerals Fluid

Fluids are specially formulated liquids that are injected into a vein to prevent or treat **dehydration**. They are used in people of all ages who are sick, injured, dehydrated from exercise or heat, or undergoing surgery. Intravenous rehydration is a simple, safe and common procedure with a low risk of complications

### A. Isotonic fluids

have the same osmotic pressure as that found within the cell

used to expand the intravascular compartment and thus ↑se circulating volume.

do not alter serum osmolarity

are helpful for hypotension caused by hypovolemia.

E.g- Normal saline (0.9% NaCl)

- lactated Ringer's solution

- 5% DW

### B. Hypotonic fluids:

have less osmotic pressure than the cell

when these fluids are infused, they lower serum osmolarity, causing body fluids to shift out of the blood vessels and interstitial space.

used for cellular hydration.

E.g. - 0.45% NaCl

- 5%DW can also be used as hypotonic fluid after the dextrose is metabolized.

### Hypertonic fluids:

have greater osmotic pressure than the cell

When a hypertonic solution is infused, it raises serum osmolarity pulling fluid from the cells and the interstitial tissues into the vascular space.

E.g. 3% saline

5% saline

5% DW with normal saline

5% DW with lactated Ringer's solution

Higher concentration of dextrose such as 50%DW

Vitamins and minerals

## I. Minerals

Minerals chemical element required as an essential nutrient used to perform functions necessary for life.

### Function or use of minerals

For health Bone and Tooth Health. Your skeleton provides motility, protection and support for the body.

Energy Production. You require oxygen to produce energy that is necessary for every bodily function and process.

Nerve and Muscle Function. ...

Immune Health.

Minerals, such as sodium ( $\text{Na}^+$ ), potassium ( $\text{K}^+$ ) and chloride ( $\text{Cl}^-$ ), are important constituents of body composition.

When dissolved in body fluids, they exist as acids, bases, and salts these dissolved minerals are referred to as electrolytes

### Sodium ( $\text{Na}^+$ )

the main cation of extracellular fluid, plays a major role in maintaining normal fluid balance

the kidney help to maintain normal levels of  $\text{Na}^+$  in plasma and other body fluids

Severe diarrhea, vomiting and also excessive use of diuretics causes sodium depletion, consequently fluid moves out of the intracellular compartment in an effort to maintain blood volume

If the lost sodium and water are not replaced, blood volume and BP decrease and circulatory collapse may occur.

$\text{Na}^+$  is administered iv in various concentrations.

### Potassium ( $\text{K}^+$ )

the main cation of intracellular fluid, is important in maintaining cell structure and function

It is also vital in the regulation of muscle function, especially cardiac muscles

Loss of potassium can produce a loss of muscle tone, weakness and paralysis

Excessive potassium levels can produce cardiac arrhythmia especially heart block

Loss of potassium can produce a loss of muscle tone, weakness and paralysis

It is administered iv as potassium chloride in various concentrations.

### Calcium ( $\text{Ca}^{2+}$ )

It is usually associated with the formation of bone also plays a vital role in muscle contraction and blood coagulation.

A deficiency in calcium in the blood results in hyperexcitability of nerve and muscle fibers (tetany)

Excessive  $\text{Ca}^{+2}$  produces muscle weakness and may lead to cardiac and respiratory failure.

## 2. Vitamins

Vitamins are a group of substances that are needed for normal cell function, growth, and development. There are 13 essential vitamins. This means that these vitamins are required for the body to work properly.

### Examples of vitamin

Name	Function
Vitamin D	Regulating calcium and phosphorus levels in blood maintaining healthy bones and immune systems
Vitamin E	Prevents damage to cell membranes
Vitamin K	Major in blood clotting maintaining healthy bones and blood vessels

### 1.23 Essential drugs list in Ethiopia

Essential medicines are those that satisfy the priority health care needs of a population. They are selected with due regard to disease prevalence and public health relevance, evidence of efficacy and safety and comparative cost-effectiveness

Disease	List of drug	Child dose	Adult dose	Duration of treatment	
Dysentery (Gastro Enteritis)	1.Ciprofloxacin	-----	500mg	BID	5-7 days
	2. Cotrimoxazol	6 wk-5mon=120mg 5mon-5ypr 240mg 5yg-12yur 480mg	960mg	BID	5-7 days
	3. Nalidixic acid	>3mon 50mg/kg/day	1gm	QID	5-7 days
	4. Ceftriaxone		1-2gm	BID	1-3 days



		20-50mg/Kg/day			
Nausea and vomiting	1 Metoclopramine Meclizinehydrochloride 3 Chlorpromazine 4 Promethazine 5 Dimenhydrinate	Max 0.5mg/kg _____ _____	10mg 25-50mg 12.5-25mg	TID PRN BID	
PUD	1. Mg(OH) <sub>2</sub> Al(OH) <sub>3</sub> 2. Cimetidine 3. Famotidine 4. Ranitidine 5. Omeprazole	_____ _____ _____ _____ _____	2-4tob 400mg 40mg 150mg 20mg	TID BID Daily BID BID	2 wks 2weeks 4weeks 2weeks 2weeks
Haemorrhoid	1. Bismuth subgallate 2. Bismuth subgallate	_____ _____	1 supp 1	BID BID	5 day 5 day
Sinusitis	1 cotrimoxazole	24mg/kg	960mg	BID	7
Bronchitis	1 dextromethorphan 2. Codeine	- 6-12yer=7.5-15mg - 2-6yer =7.5mg	15-30mg # 10-20mg	QID QID	7days 7 7



	phosphate	# 0.5mg/kg	-250-500mg	TID	7
	3. Amoxacillin	-20-40mg/kg/day	@ 250-500mg	QID	7
	4. Ampicillin	@ 20-40mg/kg/day		QID	7
	5. Erythromycine	-15-20mg/kg/day	-250-500mg	QID	7
	6. Tetroucycline	_____	250-500kg	BID	
	7. Cotrimoxazol	—	960mg		
		6 wk-5mon=120mg			
		5mon-5ypr 240mg			
		5yg-12yur 480mg			
Pnpumonia	1.Amoxacilline	20-40mg/kg/day	500mg	TID	7
	2.Erytrimycin	15-20mg/kg/day	500mg	QID	7
	3.Procoine penicillin	_____	800,000IU	BID	7
		20-50mg/kg/day	1gm	BID	7
	4.Ceftriaxone	20-40mg/kg/day	500mg	QID	
	5. Ampicillin	5-7 mg/kg	80mg	TID	
	6 .Gintamycine				
Tonsilitis	1. Amoxacilline	20-40mg/kg/day	250-500mg	TID	10
	2. Ampicillin	50-100mg/kg/day	250-500mg	QID	10
	3.Procaine peniciuine	—	—	BID	
		12.5mg/kg	250-500mg	QID	10
	4.Erytromycin	Depins on age	1.2-2.4IU	Stat	
	5Benzanthine				

	penicilline				
B. Asthma	1. Solbutamol 2. Aminophylline 3. Adremaline 1:1000 4 Prodnisolone 5.Ephearine+theo phyllin 6. Beclamethasone	2.5-5mg 5mg/kg      	2.5-5mg 5mg/kg 0.5ml 40-60mg 100mg 1000mg	_____ IV push _____ TID Daily	2wks
Pertusis	Erytromycihp	12.5mg/kg	—	QID	10day
CHF	Digoxin Furosemide Enalapril Speronolactone Coptopril	        	0.125- 0.375mg 40-240mg 600mg 5-40mg 25-100mg	Dily 2-3times Dayly 1-2times 1-2times	
Bacteri al Endoca	C.peniciuin Gentamycin	   	12-18 milion IV/day	Every 4hr TID	2wks





rditis	Vancomycine	_____	1mg/kg	BID	04wks
	Cloxaciuine	_____	15mg/kg 2gm	Evrvy 4hr	4-6wks
Arrhyth mia	Prophanelol	_____	10-40mg	3-4times	
	Verapamil	_____	40-80mg	2-3times	
	Digoxin	_____	0.25-	1 times	
	Quinidine	_____	0.375mg 300-600mg	QID	
Hyperte ntion	1.HCT	_____	12.5-50mg	TID	
	2. Nifedipine	_____	10-40mg	TID	
	3. Propranolol	_____	40-160mg	2-4times	
	4. Enalapril	_____	2.5-40mg	1-2times	
	5. Methyldopa	_____	250-2000mg	TID	
Rheum atic Fever	1.Benzanthin penicillin	Depend on Age 12.5mg	2.4 IU 250-500mg	Stat QID	10 day  2wks
	2.Erythromycin	_____	2gm	QID	
	3.ASA	_____	30mg	QID	
	4.Prednisalone	_____			
UIT	1.Cotrimoxozol	6 wk-5mon=120mg  5mon-5ypr 240mg  5yg-12yur 480mg	960mg	BID	5



	2.Nurfloraxine	_____	400mg	BID	5
	3.Amoxaciline	—	250-500mg	TID	7
	4.Gentamycine	20-40mg/kg/day 5-7mg/kg	80mg	2-3time	7
Amebiasis	Metronidazole	7.5mg/kg	750mg	TID	5-7days
	Tinidazole	50-60mg/kg	2gm	Daily	3day
	Diloxanide furoate	Chl>25kg 20mg/kg/day	500mg	BID	10day
Giardiasis	Metronidazol	Chl 1-3 year 500mg 3-7yer -600-800mg 7-10 1gm Daily for 03 days	500mg TID for 05days 2gm	Stat	
Ascariasis	Piperazine		4g	Stat	
	Levamisol		120-150 mg	Stat	
	Mebendazole		100mg	BID	
	pyrental,		700mg	Stat	
Enterobiasis	mebendazole		100mg		
	Albendazole		400mg		
	piperazine		700mg		



Hook worm infestation	mebendazole  Albendazole  pyrental		100mg  400mg  700mg		
Strongly yloidosis	thiabendazole  Albendazole		1500 mg  400mg	BID	02
Trichur asis	Mebendazole  Albendazole		100mg  400mg	BID  stat	
Tapeworm	Niclosamide,  Albendazole  praziquanta  mebendazole ,		2gm  400mg  600mg  100mg	Stat  stat  Stat  BID	03days
Malaria P.F	1 coartim         2. Quinine	6-14kg--1tab  15-24 kg---2 tab  25-34---3tab  >34-----4tab  10mg/kg	BID        TSD	03day        7day	
	Choloroquine	25mg/kg	25mg/kg	1 <sup>st</sup> day=10mg	



Malaria P.V	Primaquine-		15mg	2 <sup>nd</sup> day=10mg 3 <sup>rd</sup> day=5mg	
				dayly	4d ay
Mening itis	C. pensilline	500,000Iv/kg/day	3min,ou Iv	Every 4hr	7-
	CAF	100mg/kg/day	500mg	QID	10
	Cettriaxone	100mg/kg/day	2gm	BID	da ys
					7d ays 7d ays
Relapsi ng fiver	PPF	25,000-50,000IU	400,000IU	Stat	
	TTC	—	500mg	Stat	
Typhoi d fever	1CAF	25mg/kg	500mg	QID	14
	2Amoxacillin	20-40mg/kg/day	1gm	TSD	da ys
	Ciprofloxacin	-----	500mg	BID	14
	Ceffriaxone	20-50 mg/kg/day	1gm	BID	da y 7d ay 5- 7d ays

Typhus	TTC	-----	2500mg	QID	7d
	CAF	25mg/kg	500mg	QID	ays
	Doxycycline then	-----	200mg	Stat	7d
	Doxycycline	-----	100mg	BID	ays
Osteomyelitis	1. cloxacilline		500mg	QID	2-4 wks
Epilepsy	1. Phvno barbition		60-80mg	Dayly	
	2. Phentoin		200-300mg	Daily	
	3. Carbamazepine		600-800mg	Daily	
Diabetes mellitus	Type 1. Insullin		20-25IV	BID	
	Type 2. Glibenclamide		2.5-20 mg	BID	
	Metfurmin		500-2000mg	Daily	

Table 2. Essential drug list in Ethiopia

Self- Check 1	Writing Test
---------------	--------------

**Directions:** Read the instruction for each part and do accordingly

I.. Multiple choice;

**Instruction:** chose the best and write your answer on the space provided for the part on answer sheet  
undesirable effects apparent in the recipient like toxic, teratogenic is described as

- a . drug interactions                      b. adverse reactions
- c side effects                                  d mechanism of action

conditions or symptoms that alert the health care practioner to the potential dangers of the drug

Adverse reactions      b. . drug interactions

- c.. side effects                      d. Contraindications

3. Measures taken to prevent or reduce adverse effects

- a. nursing care      b. medication      c. safty measure      d.. Precautions

4. One of the following is not included under properties of ideal drug

- a. Effectiveness      b. no side effects      c. habit forming      d. Selectivity:

5. study of the biochemical and physiological effects of drugs

- a. Pharmacodynamics      b. drug absorption      c. Pharmacokinetics      d..excetion

6. movement from site of administration into blood is best described as

- a. absorption      b. distribution      c. excretion      d. mechanism

7. Enzymatic alteration of drug structure is termed as

- a. side effects      b. drug effect      c . reaction      d. metabolism

8 One of the following is . Passive transport of drug in the body

- a. Simple diffusion      b. movment of drug against their concentration gradient
- c. Facilitated diffusion      d. Endocytosis

9.one of the following is included under sever adverse reaction of drug

- a. Drowsiness                      b..Nausea, c. itching      d. Hepatocellular injury

10. the intensity of drug side effect is dose dependent      a. true      b. false

Part II Matching

**Instruction:** Match appropriate words or phrases from column B to column A

**Column A**

**Column B**

- 1.. Proton- pump inhibitors                      A. Histamine H<sub>2</sub>-receptor antagonists
- 2. Antacids    B. laxatives

3. Cimetidine
4. Psyllium
5. Chlorpromazine
- C. Omeprazole
- D anti emetics
- E. alkaline compounds

Part III : True /False question ,

**Instructions** :Write true if the stetment is correct otherwise false on the answer sheet provided for this part

- 1.NSAIDs work by inhibiting the synthesis of molecules known as prostaglandins
- 2.One side effect of NSAID is stomach ulcers
3. corticosteroid is included under non steroid anti inflammatory drugs drugs
4. Fever mild to moderate pain and arthritis can be treated with Ibuprofen
5. Paracetamol have anti-inflammatory effect
6. Topical phenylephrine is drugs classified as nasal decongestants
7. Beta2 agonists is anti asthmatic drugs grouped under bronchodilators
8. Glucocorticoids reduce symptoms of asthma by bronchial dilatation
9. Hypertension, systemic infection, diabetes contraindication for immunosuppressive therapy
10. ACE Inhibitors are grouped under cardiac drug

#### Part IV: Easy questions

**Ins:Give short and brief answer for the following questions**

List categories of cardiac drug and describe their mechanism of action and common side effect

List at least 3 categories of CNS drug and explain the use of each

List ophthalmic drugs and discuss their therapeutic indication

List dermatological drugs and discuses their use

List common drugs of musculoskeletal system and explain their indication

**Note: Satisfactory rating – scoring 50% Unsatisfactory – blow 50%**

#### Answer Sheet

Score= \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_ Date: \_\_

**Part I Multiple choice**

- 1.-----6.-----
- 2.-----7.-----
- 3.-----8.-----
- 4.-----9.-----
- 5.-----10.-----

**Part II matching**

- 1.-----
2. -----
- 3.-----
- 4.-----
- 5.-----

**Part II. True/False Part**

- 1.----- 6.-----
2. ----- -7. -----
- 3.----- 8.-----
4. ----- 9.-----
- 5.-----10.-----



## Unit two: Safe Medication Administration

### Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics

Checking expiate date

Medication chart

Common contraindications and adverse reactions

Checking allergies

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to:**

Identify risk for medication error

Define expiry date of drug

Explain the use of medication chart

Identify common contraindication and adverse effect of drug

Use medication chart after provision of medication

Identify drug allergy

#### **Learning Instructions:**

Read the specific objectives of this LearningGuide

Follow the instructions described below 3 to6

Readtheinformationwrittenintheinformation—Sheet1,Sheet2,andSheet3

Accomplish the —Self-check 1, Self-check t 2, and Self-check3.

If you earned satisfactory evaluation from the—Self-check proceed to—Operation Sheet1.

Do the —LAP testl **in page** – \_\_\_\_ (if you areready)

### **2.1 Expiate date**

The expiry date usually means that you should not take the medicine after the end of the month given.

For example, if the expiry date is July 2020, you should not take the medicine after 31 July 2020

Drug expiration dates reflect the time period during which the product is known to remain stable, which means it retains its strength, quality, and purity when it is stored according to its labeled storage conditions.

## 2.2 .Medication chart

The national medication charts are used in inpatient settings to record the medicines prescribed and administered to a patient, along with any allergies and adverse reactions from medicines

Nurses' responsibility for medication administration includes ensuring that the right medication is properly drawn up in the correct dose, and administered at the right time through the right route to the right patient. To limit or reduce the risk of administration errors, many hospitals employ a single-dose system.

### Guidelines to help ensure correct administration

Read medication order carefully-verify

Verify identity of patient with drug order

Read medication label & verify Drug itself

Amount of drug (per tablet, per volume

Verify suitability for administration by intended route

Verify dosage calculations

*Use special handling if drug requires*

*DO not administer any drug if you do not understand the reason for its use*

Must know action of pharmacokinetics of drug in order to maximize effectiveness of action

-- Must maximize drug at site of action

-- Must minimize side effects of high concentrations of drug (avoid high concentrations)

[Zithromax=Azithromycin]

-- Scheduling of drug administration

---Route of administration

## 2.3 Contraindications and adverse reactions

Adverse reactions

An adverse drug reaction (ADR) can be defined as 'an appreciably harmful or unpleasant reaction resulting from an intervention related to the use of a medicinal product; adverse effects

usually predict hazard from future administration and warrant prevention, or specific treatment, or alteration of the dosage regimen,

The most common ADRs are

constipation,

nausea +/- vomiting,

fatigue,

alopecia,

drowsiness,

myelosuppression,

skin reactions,

anorexia, mucositis and diarrhoea.

..Adverse drug reactions are classified into six types (with mnemonics):

dose-related (Augmented),

non-dose-related (Bizarre),

dose-related and time-related (Chronic),

time-related (Delayed),

withdrawal (End of use), and

failure of therapy (Failure).

Management of drug adverse effect

Start with low doses and frequencies and slowly titrate as tolerated.

Initiate less-potent agents, agents with direct mechanisms of action, or alternatives with lower adverse event incidence.

Avoid or reduce the use of interacting medications.

Prescribe dosage forms with minimal systemic exposure (eg creams, patches)

## 2.4 Drug allergy

A drug allergy is the abnormal reaction of your immune system to a medication. Any medication — over-the-counter, prescription or herbal — is capable of inducing a drug allergy. However, a drug allergy is more likely with certain medications.

The most common signs and symptoms of drug allergy are

Skin rash or hives

Itching

Wheezing or other breathing problems

Swelling

Anaphylaxis, a potentially life-threatening reaction that can simultaneously affect two or more organ systems (for example, when there is both a rash and difficulty breathing)

Reactions can occur in any part of your body.

Common Triggers of Drug Allergies

Penicillin and related antibiotics

Antibiotics containing sulfonamides (sulfa drugs)

Anticonvulsants

Aspirin, ibuprofen and other nonsteroidal anti-inflammatory drugs (NSAIDs)

Chemotherapy drugs

Diagnosis of drug allergy

Skin test (accurate only for penicillin)

Drug challenge

Management and Treatment

Avoid triggers.

Seek immediate medical care if symptoms worsen or multiple symptoms occur together (anaphylaxis).

Ask and assess for history of allergy

Take history of anaphylaxis, wear a medical alert bracelet that lists the trigger.

Contraindications

Definition: Are the conditions that make a medication or process not recommended.

A drug's contraindications outline the reasons that a person should not receive a treatment due to potential harmful effects.

One example of a contraindication to a drug is a known allergy to it or any of its components. Taking a drug when there is a known allergy can lead to an allergic reaction, which, in some situations, can be fatal.

Drug indications and contraindications are first determined by the drug's manufacturer and verified by the Food and Drug Administration (FDA). When a prescription or over-the-counter (OTC) drug is under development, the manufacturer determines the specific uses, including the doses to be used. The FDA then will evaluate the drug for these specific uses, looking at both the drug's effects and safety before granting permission for the drug to be sold in the USA.

Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next

Instruction: answer the following question according to the intention the the questions

1..Define expiry date of drug

2 Explain how do check expiry date

Write the use of medication chart

List information contained in medication chart

Define Adverse reactions of drug

Give examples of contraindicatio

*Note:* Satisfactory rating –3 points Unsatisfactory - below 3points

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score= \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_ Date: \_

## Unit Three: Medication preparation

### Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

Common terminology associated with drug, fluid and electrolytes

Medication preparation

Forms of medication

3Site of injections

Route of administration

Principles of medication administration

Potential risk related with medication administration

Storing & handling of medication

Delivery of drug doses

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

Define common terms associated with drug, fluid and electrolytes

Identify types of electrolyte

Explain function of electrolyte

Define Medication

Identify forms of medication

Identify site of injection

List Route of administration

Identify risk related with medication administration

#### Learning Instructions:

Read the specific objectives of this LearningGuide.

Follow the instructions described below 3 to6.

Read the information written in the information —Sheetsrespectively.

Accomplish the —Self-checksrespectively

## 2.1 Common terminology associated with drug, fluid and electrolytes

### Key terms

**Hyper-:** A condition that starts with “hyper” means it involves too much of something.

**Hypo-:** A condition that starts with “hypo” means it involves too little of something.

**Ion:** An atom that has an electrical charge.

**Cations:** Ions with a positive charge.

**Anions:** Ions with a negative charge.

**pH:** A scale that measures whether a liquid is an acid or base. Your body’s natural blood pH is between 7.36 and 7.44.

**Acidic:** Has a pH of less than 7.

**Neutral:** Has a pH of 7.

**Basic:** Has a pH of more than 7 (basic is also known as “alkaline”).

### Electrolytes

A substance that breaks up into ions (particles with electrical charges) when it is dissolved in water or body fluids. Some examples of ions are sodium, potassium, calcium, chloride, and phosphate.

Are substances that have a natural positive or negative electrical charge when dissolved in water.

The body gets electrolytes or their components from what you eat and drink. The kidneys filter excess electrolytes out of your body and into your urine. You also lose electrolytes when you sweat

Common electrolytes include

sodium, chloride, potassium, magnesium and calcium.

...

Function

Controlling your fluid balance.

Regulating your blood pressure.

Helping your muscles contract — including your heart.

Maintaining the correct acidity of your blood (pH).

They help your body regulate chemical reactions, maintain the balance between fluids inside and outside your cells, The muscles and neurons are sometimes referred to as the “electric tissues” of the body.

They regulate nerve and muscle function, hydrate the body, balance blood acidity and pressure, and help rebuild damaged tissue

## Medication

A drug or other form of medicine that is used to treat or prevent disease.

Treatment using drugs.

is a substance administered for the diagnosis, cure, treatment, mitigation (relief), or prevention of disease.

*Drug:* - is any substance that alters physiologic function, with the potential for affecting health.

"chronic gastrointestinal symptoms may require prolonged medication"

## 3.2 Medication preparation

Medical preparation from a vial is the method of preparing a drug contained in a vial into a usable form that is safe and effective for human delivery.

### Purpose

To facilitate safe and effective delivery of medications.

To transform the medication from solid form to fluid form where appropriate.

To prepare and transport the medication to equipment more suitable for final delivery.

### Precautions

There are several precautions that health care providers need to keep in mind when preparing medications. These precautions protect both the practitioner and the patient. Risks most common to the health care provider include needlestick injuries from the equipment used to prepare the medication and the risk of splashing harmful drugs onto the skin, eyes and other mucous membranes, by which the body may uptake all or part of the drug. These are generally caused by incorrect methods of medication

### Start with the basics

Verify any medication order and make sure it's complete. ...

Check the patient's medical record for an allergy or contraindication to the prescribed medication. ...

Prepare medications for one patient at a time.

Educate patients about their medications. ...



Follow the eight rights of medication administration.

### 3.3 Forms of medication

There are three dosage forms: solid, liquid and gas.

#### Solides

Tablettes	Pellets	Granules	Capsules	Dusts
Troches	Powders	Patches		

**Tablets:** Small disc like masses of medical powder that have been compressed sufficiently to maintain their shape.

The term pill is sometimes used to spherical or pellet shaped tablets

Most tablets are administered orally

The buccal form of tablet is designed to lodge in the mouth between the cheek and gum until dissolved and absorbed.

The sublingual form of tablet is designed to be placed beneath the tongue until dissolved and absorbed.

The enteric coated form contains an outside layer that does not dissolve until the tablet reaches small intestine.

Coated tablets have an outside layer, usually of sugar.

Sustained-release forms of tablets are designed to be released and absorbed gradually or in controlled manner.

#### Capsules:

Gelatin cases used to enclose solid (powder, granule or beads) or liquid drugs.

Melt and release the drugs quickly after ingestion.

#### Troches:

Disc- shaped or cylindrical medications consisting chiefly of medical powder, sugar and mucilage

Designed to be placed in a body cavity for absorption by the mucous membrane

**Pellets:** small pills or balls of medication

**Patches:** Resemble small adherent dressings; contain medication in a central area surrounded by an adhesive rim. The drug may be imbedded in the adhesive ring or in the central area.

**Powder:** measured doses of solid medication in pulverized form usually dissolved in water before ingestion.

**Granules:** dry medications that resemble powders, but their particle size is larger than those in powder

**Dusts:** very fine powder may be applied topically to the skin or mucus membranes or administrated by inhalation as a mist.

### Semisolids

Suppositories	Ointments
Pastes	Creams
Foams	

**Suppositories:** cylindrical or cone –shaped medications whose vesicles (cocoa butter) melt at body temperature. They are available for the rectum, vagina or urethra.

**Pessaries:** are vaginal suppositories

**Pastes:** thik, gelatinous substance usually intended for topical application to the skin.

**Ointments:** fatty substances (petrolatum or lanolin) containg a drug that is applied to the skin or eyes.

**Creams:** Topical preparation that are less viscous than ointment

**Foams:** Are mixture of finely dispersed gas bubbles in a liquid

E.g contraceptive vaginal foams

### Liquids

Solutions	Elixirs	Suspensions
Lotions	Tinctures	Emulsions
Liniments	Syrups	

**Solutions:** Mixtures of two or more substances dissolved in another substance. May be administered orally, rectally, topically, by injection or as a mist by inhalation, can also be instilled in he eye, nose.

**Lotions:** liquids with a creamy consistency that are applied topically to the skin.

**Liniments:** liquids containing alcoholic, oily or soapy vechile. Rubbed on the skin and usually act as counter irritants.

**Elixirs:** Clear liquids containing water, alcohol, sweeteners and flavors; usually administered orally.

**Tinctures:** Alcoholic extracts of vegetable or animal substances, may be administered topically or orally.

E.g Tincture of belladonna

**Syrups:** Solution of sugar and water, usually flavored, to which a drug is added

Syrups are used for palatability, especially in pediatric medication.

**Suspensions:** Mixtures of solids and liquids in which the solid particles do not

**Dissolve.** These mixtures tend to separate on standing and must be shaken well before use.

**Emulsions:** Mixtures of oil and water that are not mutually soluble.

**Gases:** Administered by inhalation, many are used as general

### 3.4 Site of injections

The anatomic site at which a medication or a vaccine is injected

A common types of injection: are intradermal, subcutaneous, intravenous and intramuscular injections, Intramuscular injections, abbreviated as IM, deliver a substance deep into a muscle, where they are quickly absorbed by the blood vessels into systemic circulation.

Common injection sites include

Deltoid muscle of the arm. The deltoid muscle is the site most typically used for vaccines. ...

Vastus lateralis muscle of the thigh. ...

Ventrogluteal muscle of the hip. ...

Dorsogluteal muscles of the buttocks.

Sites for subcutaneous injection include

The lateral aspects of the upper arm and thigh, and the umbilical region of the abdomen

**Intradermal:** injections are delivered into the dermis, or the skin layer underneath the epidermis (which is the upper skin layer). The dermis is, on most places of the human body, only a few mm thick

**Note:** You will learn this topic in the next

### 3.5 Route of administration

Routes of administration means the way or route through which medication is administered

The routes of administration that are used most commonly are enteral (via gastrointestinal tract), parenteral, and topical.

#### Oral

PO, stands for per os, Latin phrase meaning by way of the mouth.

Most commonly used route of drug administration

The major barrier to absorption is the GI epithelium (the lipid bilayer of cell membrane).

Because of multiple factors, the rate and extent of drug absorption following oral administration can be highly variable

advantages of oral administration

Easy, convenient, and inexpensive

Safer- There is no risk of fluid overload, infection or embolism and it is potentially reversible.

## **Disadvantages of Oral Administration**

Variability- Variability in rate and extent of absorption, makes it difficult to control the concentration of drug at site of action, this in turn makes it difficult to control the onset, intensity and duration of response.

Inactivation of certain drugs by change in GIT pH and enzymes limits the use of these drugs orally.

Difficult to use in unconscious patients

Local irritation of the GI tract with some drugs can result in discomfort, nausea and vomiting.

### **Parenteral**

The term parenteral is used to mean by injection

Includes: Intravenous (IV) intramuscular (IM) subcutaneous (SC), intra peritoneal, intra-articular, intra dermal.

### **Intravenous (IV)**

Drugs directly given in to a vein, there are no barriers of absorption.

### **Advantages**

Rapid onset of drug action, beneficial in emergencies

Permits the use of large volume of fluid.

Irritant drugs can be used

### **Disadvantages**

High cost, difficulty, and inconvenience

Irreversibility: once a drug has been injected there is no turning back

Fluid overload

Infection

Embolism:- blood vessel blockage at a site distant from the point of administration

### **Intramuscular (IM)**

Injections can be given to deltoid or gluteal muscle

Poorly soluble substances, mild irritants, suspensions and colloids are injected by this route

### **Subcutaneous (SC)**

The pharmacokinetics are nearly identical to im.

### **Intra peritoneal**

Injections given into abdominal cavity.

### **Intra dermal**

Injected in to the layers of the skin e.g B.C.G-vaccine

### 3.6 Principle of medication administration

Principle are guide lines the the nurse should follow for safe medication administration

Nurse must have knowledge of

Patient history and drug usage

What medications are appropriate and be aware of drug interactions (cooperation between doctor, pharmacist and nurse a must)

- Drug actions and look for abnormal effects
- How to be a patient advocate- check for mistakes on part of doctor or pharmacist!! – Do NOT blindly follow Dr's orders-- THINK and respond to errors [ do not be intimidated]

### 3.7 Potential risk related with medication administration

Medication Error

It is any preventable event that lead to in appropriate medication use

Cause

Inaccurate recording of order

Un clear labeling of drugs

Miss identification of clients

Incomplete delivery of drug

Verification

Use of inaccurate knowledge

Time & performance pressures

### 3.8 Storing & handling of medication

Heat, air, light, and moisture may damage the medicine. Store your medicines in a cool, dry place. For example, store it in your dresser drawer or a kitchen cabinet away from the stove, sink, and any hot appliances. You can also store medicine in a storage box, Drugs must be stored in a locked cupboard or medical fridge according to the manufacturer's recommended temperature range. The appropriate emperature range should be monitored and both a room thermometer and fridge thermometer is required to enable this.

**Storage:** is an important aspect of the total drug control system. Proper environmental control (i.e., proper temperature, light, and humidity, conditions of sanitation, ventilation, and segregation) must be maintained wherever drugs and supplies are stored in the premises.

**Handling :** The manipulation of medications in order to administer them.

Medicines must be stored securely in an environment that will not affect their potency.

All healthcare organisations should have Standard Operating Procedures and policies in place to ensure compliance with the manufacturer's storage recommendations and the relevant legislation, for example the storage of controlled drugs. Drugs must be stored in a locked cupboard or medical fridge according to the manufacturer's recommended temperature range.

The appropriate temperature range should be monitored and both a room thermometer and fridge thermometer is required to enable this. Organisational policies should be available to ensure that medicines requiring storage within a medical fridge, for example Syntocinon, are stored appropriately when used within the community setting. Midwives must also follow organisational policy for the supply, storage, administration and disposal of controlled drugs that may be used in hospital and community settings.

Steps should be taken to prevent human error and potential harm.

Drugs should be stored to minimise mix-ups between medications of a similar appearance, for example intravenous (IV) solutions bags and vials of sterile water, normal saline and lidocaine.

Measures should also be in place to reduce distractions that may occur in a busy care environment during drug rounds and the making up of IV infusions. Midwives should never prepare substances for injection in advance of immediate use or administer medication drawn into a syringe or container by another practitioner when not in their presence.

### **3.9 Delivery of drug doses**

Drug delivery systems describe technologies that carry drugs into or throughout the body. These technologies include the method of delivery, such as a pill that you swallow or a vaccine that is injected. Drug delivery systems can also describe the way that drugs are 'packaged'—like a micelle or a nanoparticle—that protects the drug from degradation and allows it to travel wherever it needs to go in the body

A drug delivery system is a formulation or a device that enables the introduction of a therapeutic substance in the body and improves its efficacy and safety by by controlling the rate, time and place of release of

drugs in the body. Drug delivery systems (DDSs) are pharmaceutical formulations or devices that help in achieving targeted delivery and/or controlled release (CR) of therapeutic agents in our body [ Following administration, the DDSs liberate the active ingredients, and subsequently, the bioactive molecules are transported across various biological barriers to reach the site of action.

## Drug delivery system

### Routes of Delivery

Medications can be taken in a variety of ways—by swallowing, by inhalation, by absorption through the skin, or by injection. Each method has advantages and disadvantages, and not all methods can be used for every medication. Improving current delivery methods or designing new ones can enhance the use of existing medications

Self-Check – 3.

Written Test

**Directions:** Answer all the questions listed below according to the instruction

**Part I :** multiple choice-choose the best answer and write your answer on the space provided in the answer sheet part

One of the following is solid form of medication

a. tablettes b. suppositories c. creams d. foams

2. A mixture of finely dispersed gas bubbles in a liquid is classified as

a. Creams b. Pastes c. Ointments d. Foams

3. Enteral rout means :

a. via gastrointestinal tract b.. parenteral c. topical. d. intradermal

4. Describe technologies that carry drugs into or throughout the body

a. drug delivery systems b.handling c storing d. route of administration

5. Identify the one that is disadvantage of oral rout

a. Easy b. convenient c. inexpensive d.. Inactivation

6.Among the following one is not advantage of Intravenous (IV) rout

a. Rapid on set b. Permits the use of large volume of fluid.

c. Irritant drugs can be used d. embolism

7. one of the following is site of Intramuscular (IM) injection

a. gluteal muscle b. layers of the skin c. abdominal cavity d. all

8. one of the following is not cause for *Medication Error*
- a. Inaccurate recording of order   b. clear labeling of drugs  
c. Miss identification of clients   d. Incomplete delivery of drug
9. Heat, air, light, and moisture can increase potency of drug
- a. true   b. false
10. Medicines must be stored securely in an environment that will not affect their potency
- True   b. false
11. Proper environmental control implies proper temperature, light, and humidity, conditions of sanitation, ventilation, and segregation
- a. False   b. true

## Part II Matching

Match appropriate words or phrases from column B to column A

### Column A

### Column B

Hyper	A. Has a pH of more than
Hypo	B. Has a pH of 7
Ion	C. Has a pH of less than 7
Ph	D. measures whether a liquid is an acid or base
Cations	E. Ions with a negative charge
Anions:	F. ions with positive charge
Acidic	G.. atom that has an electrical charge
Neutra	H. too much of some thing
Basic	I. too little of something

**Note: Satisfactory rating –10 points**

**Unsatisfactory – below 10 points**

### Answer Sheet

Score= \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_      Date: \_



## Unit Four: Medication administration

### Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

#### Medication administration

rights of medication administration

Administering Oral medication

Administering intra-dermal medication

Administering subcutaneous medication

Administering intravenous medication

Administering intravenous infusion

Administering blood transfusion

Applying topical medication

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

Define medication

Identify the rights of medication administration

Identify routs of medication administration

Explain advantage and disadvantage of each rout of medication administration

Perform medication administration procedure

#### Learning Instructions:

Read the specific objectives of this LearningGuide

Follow the instructions described below 3 to6

Readtheinformationwrittenintheinformation—Sheet1,Sheet2,andSheet3

Accomplish the —Self-check 1, Self-check t 2, and Self-check3.

Ifyouearnedasatisfactoryevaluationfromthe—Self-check proceedto—Operation Sheet1.

Do the —LAP test| **in page – \_\_\_\_** (if you are ready)

#### 4.1 The rights of medication administration

Medication administration: the direct application of a prescribed medication—whether by injection, inhalation, ingestion, or other means—to the body of the individual by an individual legally authorized to do so.

Benefits are effective management of the illness/disease, slowed progression of the disease, and improved patient outcomes with few if any errors. Harm from medications can arise from unintended consequences as well as medication error (wrong medication, wrong time, wrong dose)

*The right of drug administration are used as a medication guide line to avoid medication error*

*Purpose*

*To avoid medication error*

*To administer medication safely*

*To respect the right of the patient*

#### **The 10 rights of medication administration**

Right patient. Check the name on the prescription and wristband. ...

Right medication. Check the name of the medication, brand names should be avoided. .

Right dose. Check the prescription. ...

Right route. ...

Right time. ...

Right patient education. ...

Right documentation. ...

Right to refuse.

## 4.2 Oral medication

**Definition** - Oral medication is administration of drug by mouth.

Objective: - At the end of this lesson, the learner will be able to

Identify drugs given by mouth

Identify the rights of medication administration

3. List indications and contraindications of oral route administration

4. Identify necessary equipment's needed for oral administration

5. Perform oral medication operation

### **Purpose:-**

To provide a safe, effective, economic route for administering medications

Provide a sustained drug action with minimal discomfort.

When local effects on the GI tract is required

When prolonged systemic action is desired.

### **Types of medications:**

Tablets                    --capsules

Syrups                    -powder

### **Precaution:**

drugs which are irritant to the mucus membrane of the GI tract

hepatitis patients

renal failure

alcohol addicted patients.

### **Contraindication:**

When a client can not swallow or is nauseated or vomiting.

Unconscious patients.

Relative contraindications to giving oral medications include NPO status.

### **Advantages:**

Usually the simplest & easiest to take.

Minimizes client discomfort & is associated with the fewest side effects of any route

Oral medications tend to be less expensive.

***Side effects:***

Nausea

Vomiting

Irritation of GI tract

Abdominal disturbance

Organ (deep) damage

***Essential equipment***

Medication tray

Towel

A bowl of water for used cups

Measuring spoon

Medicine cups

A jug of water

Chart and medication care

Ordered medication

Operation Sheet 1	Administering oral medication
-------------------	-------------------------------

### Steps of Procedure

- Step 1. Wash hands, assemble equipment, and inform the patient about the procedure
- Step 2 Begin by checking the doctor's orders
- Step 3. Read the label 3 times before taking the medicine from the cupboard, after taking the medicine from container, and before returning the container back on the shelf
- Step 4 Place solution and tablet in separate containers
- For suspension shake the bottle well before pouring
- Step 5 Take medicine to the patient's bedside
- Step 6. Identify the patient by calling out his/her name and bed number
- Step 7 Stay with patient until each medicine is swallowed
- Step 8. Give water as necessary unless contraindicated
- Step 9 Record the medicine given, refused, or vomited
- Step 10 Take care of the equipment and return it to its place
- Step 11 Wash hands
- Step 12 .Write report on nurse's report book

### Quality criteria:

**Performed:** performed the step or task according to the standard procedure or guidelines=2

**Partially Performed:** unable to perform the step or task according to the standard procedure or guidelines=1

**Not Performed:** step or task not performed by participant =0

Lap Test1	Oral medication
-----------	-----------------

Name: \_\_Date: \_\_

Time started: \_\_Time finished: \_\_

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 01:00 hour.

1. provide oral medicating for patient having physician prescription of 500mg amoxiciline po every 3 hours

### 4.3 Intradermal injections

#### Objective

At the end of this lesson, the learner will be able to

1. Define intradermal route of medication administration
2. Identify the proper sites for intradermal injection
3. Assemble the necessary equipments
4. Demonstrate intradermal injection

Definition : - ID injection is an injection given in to the dermal layer of the skin, the layer of the skin located beneath the skin surface

Purpose: - Diagnostic

Allergic reaction test

Tuberculin test

-Therapeutic

Sites of injection:

Inner for arm area (midway b/n the wrist & elbow)

Upper chest

Upper arm

Across the scapula

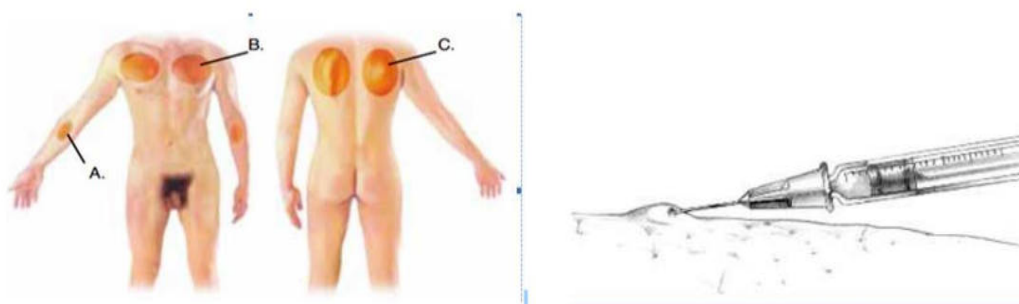


Figure. Intra dermal injection sites: A. inner aspect of the fore arm, B. Upper chest. C. Upper back

#### Size of syringe and needle;

1ml syringe and small gauge needle of 25 – 28 gauge; small volume of medication (usually 0.25 ml or less) are injected slowly.

E.g. BCG

Indication:

for vaccine administration like BCG

for drug allergy test

E.g. penicillin & TAT

For tuberculin test of T.B Sub clinical infection (time test)

Operation Sheet 2	Administering intra dermal medication
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Equipments

Tray

Syringe & needle ( sterile )

Receiver

Drug ( to be injected )

File- alcohol swab

Marking pen

Water in the bowl to rinse syringe and needle

Steps of Procedure

1. Take equipment to the patient's side
2. Explain procedure to patient
3. Get hold of the arm and locate the site of injection
4. Clean the skin with swab and inject the drug about 0.1-0.2 inch in the epidermis after the level of the needle is no longer visible do not massage the site
5. Check for the immediate reaction of the skin ( 10-15 minutes later for tetanus, 20-30 minutes later for penicillin )
6. If it is for time test mark the area
7. Chart the data and time of the administration of the drug
8. Take care of the equipments and return to their places
9. Do not forget to do the reading after 72 hrs if it is for time test ( tuberculin test )

Quality criteria:

Performed: performed the step or task according to the standard procedure or guidelines=2

Partially Performed: unable to perform the step or task according to the standard procedure or guidelines=1

Not Performed: step or task not performed by participant =0



LAP Test 2	Intra dermal medication
------------	-------------------------

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time started: \_\_\_\_\_

Time finished: \_\_\_\_\_

Instruction I: Given necessary templates, tools and materials you are required to perform the following tasks within 15 minutes

Task: Administer intra dermal medication

### 1.4 Administering subcutaneous medication

Objectives:-At the end of the lesson, the learner will be able to:

Define subcutaneous route of administration

Describe the purposes subcutaneous route of administration

Identify the necessary equipments demonstrate subcutaneous route of administration

**Definition :** - are injections given into the subcutaneous tissue, the layer of fat located below the dermis and above the muscle tissue.

#### **Purpose:**

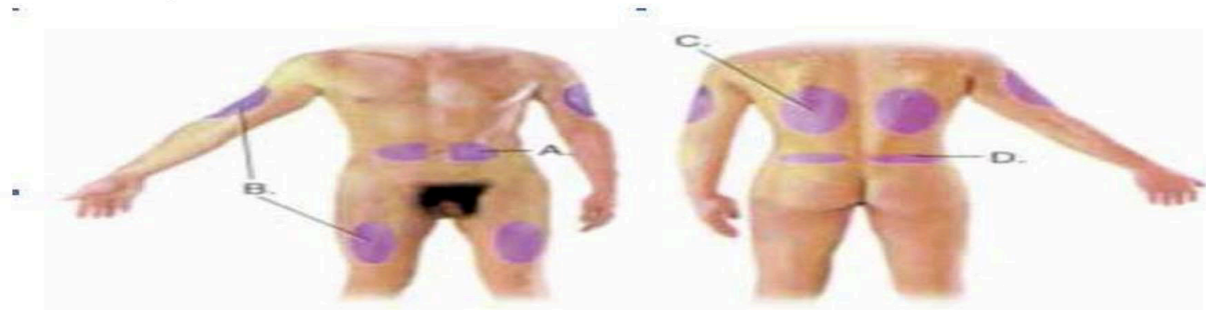
- To ensure more rapid absorption and action of a drug than can be achieved orally.
- To administer drugs to clients unable to take oral medications (i.e. unconscious, nausea/vomiting NPO status).
- To administer medications that are not active by the oral route/inactivated by the digestive enzymes (i.e. heparin, insulin)

#### **Site:**

Fatty outer portion of the upper arms, the lower abdomen, the middle and lower back, and the thigh region.

The majority of drugs given through this route should be aspirated, but aspiration is contraindicated in a select few drugs.

Maximum of 1ml can be given by 1-3ml syringe through this route.



*Figure. Subcutaneous injection sites: A. Abdomen; B. Lateral and anterior aspect of upper arm and thigh; C. Scapular area on back; D. Upper ventrodorsal gluteal area*

Speed of absorption varies with the site selected: medications injected into the abdomen are absorbed more rapidly, those injected into the arms are absorbed at an intermediate rate, and those injected into the thigh are absorbed at slowest rate.

Sites of abnormal SC tissue , such as areas lying underneath burns, birth marks, inflamed tissue, or scars, produce unpredictable medication absorption and should be avoided

Absorption may be slow or incomplete if subcutaneous medication is administered to a client with generalized edema, with severe peripheral vascular disease, or in cardiogenic shock.

### ***Precaution:***

anxiety related to fear for injections

specific drug precautions.

In patients who have phobia to injections

In psychiatric patients

In patients of HIV/AIDS

In substance abused patients.

### ***Indications:***

for administering medications for which other routes are inconvenient

to treat anaphylactic shock & bronchial asthma with adrenaline.

**Contraindications:**

- Circulatory shock

localized body areas of reduced tissue perfusion

**Size of syringe and needle:**

Small amount of medication (0.5 – 2ml) may be injected subcutaneously using a syringe with 0.025 – 2 ml size and needle gauge of 25.

Operation Sheet 3	Administering subcutaneous medication
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**Essential equipments**

Tray containing

Sterile syringe and needle

Sterile forceps with jar

Alcohol swabs

Receiver

Medication

File

Medication chart

Kidney dish water for used syringe and needle

**Steps of Procedure:**

1. Wash hands and collect equipment
2. Explain procedure to the patient
3. Take equipment to the bedside
4. Draw the medication
5. Expel the air from the syringe
6. Clean the site
7. Grasp the area between your thumb and forefinger
8. Insert the needle at about a 45° angle
9. Press the skin quickly and advance the needle

10. Aspirate three times to determine that the needle has not entered a blood vessel
11. If the needle is not in a blood vessel, inject the drug slowly
12. After injecting, withdraw the needle and massage the area with an alcohol swab to facilitate absorption
13. Chart the amount and time of administration
14. Take care of equipment
15. Watch for undesired reaction
16. Wash hands

**Quality criteria:**

**Performed:** performed the step or task according to the standard procedure or guidelines=2

**Partially Performed:** unable to perform the step or task according to the standard procedure or guidelines=1

**Not Performed:** step or task not performed by participant =0

LAP Test 3	<b>Subcutaneous medication</b>
------------	--------------------------------

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time started: \_\_\_\_\_

Time finished: \_\_\_\_\_

**Instruction I:** Given necessary templates, tools and materials you are required to perform the following tasks within 15 minutes.

**Task:** 3 perform subcutaneous medication

## 4.5 Intramuscular Injections

**Definition :** Im injection is parenteral medication administration via which medications are given into the muscle layer, beneath the dermis, and sc tissue.

### **Purpose:-**

The speed of absorption by the IM route is faster than by the subcutaneous route b/c the blood supply to the body muscles is greater.

Muscles can usually take a larger volume of fluid with out discomfort than subcutaneous tissues can although the amount varies among individuals, chiefly with the muscle size and condition.

Medications that irritate subcutaneous tissue may safely be given by IM injection.

**Types of medication:**

solutions	
Suspensions	Powders

### **Precautions:-**

In thin individuals whose blood vessels & nerves are easily accessible.

In patients who have phobia to injections

In psychiatric patients

In patients of HIV/AIDS

In substance abused patients.

### **Contraindications:**

Circulatory shock

Reduced blood flow

Muscle atrophy

Severely wasted patients

Progressive infection at the site of injection.

### **Complications:**

Pain

Nerve injury

Bone injury

Speed shock

Infection of muscle or bone.

### **Sites for injections**

Although the site choices are influenced by the age of the client, the medication to be injected and the general condition of the client, the most common sites are:

--Gluteus muscle

--Deltoid muscle

- Vastus lateralis

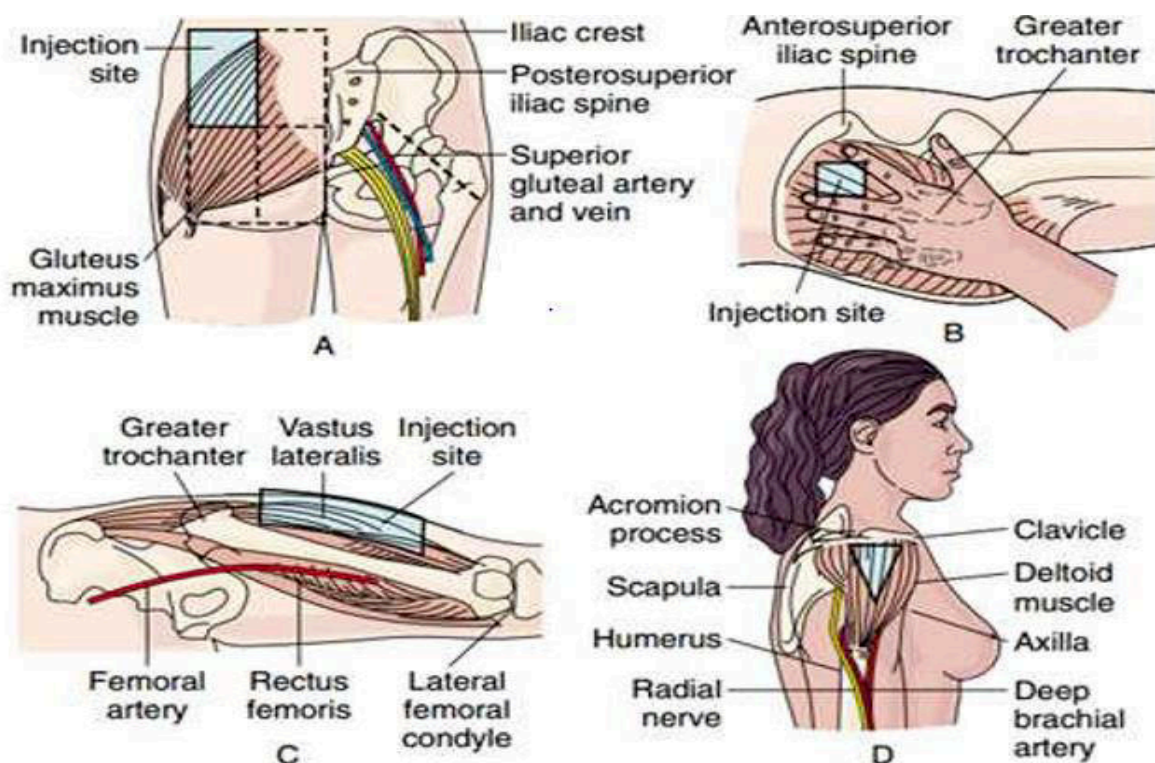


Fig site of intra dermal injection

### Deltoid muscle:

Although this site is easily accessible its use is limited, b/c the small muscle with little overlying subcutaneous fat is not capable of absorbing large amounts of medication.

Another possibly more critical limitation on the use of this site is the danger of injury to radial nerve and brachial artery. So carefully locate the site using the anatomic land marks.

It is considered for use in adults and children over 18 months of age b/c of the rapid absorption from the deltoid area. Children younger than 18 months have poorly developed deltoid muscle and should not receive IM injection into this site.

### **Location:-**

To locate the densest part of the muscle, palpate the lower edge of the acromion and the mid point on the lateral aspect of the arm that is in the line with the axilla. A triangle with in these boundaries indicates the deltoid muscle about 5 cm below the acromion process.

OR

To locate the densest part of the muscle, place four fingers across the deltoid muscle with the first finger on the acromion process the site is three fingers breadths below the acromion process.

### **Dorso gluteal site:**

This is perhaps the most common of the four intramuscular injection sites for adults. The injection is given in to the gluteus medius muscle. B/C walking develops these muscles; this site should not be used for children unless the child has been walking for at least a year.

**Position:** prone position with toes pointing inward helps to locate the site accurately and relaxes the muscle. The pain and bleeding that may occur when injection is administered in this site are less likely in this position. An alternative position is the side lying position.

**Location:** two methods are used for locating this site:

The first and most traditional method of locating this site is to divide the buttock into quadrants and then give the injection in the upper outer quadrant. The landmarks of the dorsogluteal site are the upper ileac crest, the inner crease of the buttocks, the outer lateral edge of the patient's body and the lower edge of the buttock (inferior gluteal fold). These land marks should be palpated, not merely located by sight.

Errors can easily be made, particularly in the location of the ileac crest. Once you have established the location of the upper outer quadrant, give the injection 2 to 3 inches below the crest of the ileum.

The second method for locating the same site is more accurate when the patient is in the side lying position. Draw and imaginary line b/n the posterior superior iliac spine and the greater trochanter of the femur. An injection is given laterally and superiorly to this line b/c it runs lateral to the sciatic nerve.

**Problems with injecting drugs to dorsogluteal site are:-**

slow absorption of medication

The sciatic nerve, bone and gluteal artery lies close to the site.

Infants younger than 18 months and debilitated adults may not have enough muscle mass to allow a safe injection into this site.

The thick layer of fat over this site in many people may make it difficult to reach muscle tissue consistently.



**Note:** Medication that irritate the subcutaneous tissue or that discolor it should be given by the Z-track method. The purpose of the Z-track technique is to administer the medication into the muscle tissue with no tracking of medications in to the subcutaneous tissue and skin needle is withdrawn preventing irritation and staining, an air lock of 0.4 ml that is above the level of the medication during injection is also recommended.

### **Ventrogluteal site:**

It is the gluteus medius muscle, which lies over the gluteus minimus.

Advantages over dorsogluteal site:

No large nerve

No large blood vessel

Less fatty

Farther from the rectal area.

After children are three years old, they can receive volumes of up to 1ml in the ventrogluteal site; preschoolers can be given 1.5 ml. This site is also suitable for adults, particularly for immobilized clients, whose dorsogluteal muscle may be atrophying

Toddlers should not receive injections into the ventrogluteal site b/c muscles in this site are not well developed until a child begins to walk.

Older and debilitated clients who have lost muscle else where often have enough muscle in the ventrogluteal site.

**Position:** The patient can be placed in one of several positions: prone, side lying, standing,

**Location:** The landmarks of the ventrogluteal site are the greater trochanter, the crest of the ileum and the superior anterior iliac spine. To locate this site first locate these landmarks on the patient and then place the heel of your opposite palm on the greater trochanter, point one finger toward the anterior superior iliac spine and an adjacent finger toward the crest of the ileum, forming a triangle with the iliac bone. The injection is then given in the center of the resulting triangle.

### **Vastus lateralis site:**

It is usually thick and well developed in both adults and children.

It is increasingly recommended as the site of choice for intramuscular injections for infants b/c there are no major blood vessels or nerves in the area.



### Location:

In infants and children it is situated on the anterior lateral aspect of the thigh. It is established by dividing the area b/n the greater trochanter of the femur and the lateral femoral condyle in to thirds and selecting the middle third.

In adults it is located b/n one hand breadth above the knee and one handbreadth below the greater trochanter on the medial outer portion of the thigh.

**Position:** back lying or sitting position

### Rectus Femoris Site:

This muscle runs down the anterior surface of the thigh.

This site can be used for occasional injections for infants and children and for adults. When other sites are contraindicated.

### Advantage:

Clients who administer medication by themselves can reach this site easily.

### Disadvantage:

Discomfort especially for those who have small muscle mass at this site.

Operation Sheet 4	Administering intra muscular medication
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### Essential equipments

The same as with other injections, except use larger needle and syringe

### Steps of Procedure

1. Wash hand and collect the necessary equipment
2. Explain procedure to the patient and bring trolley to the bedside
3. Draw the medicine
4. Expel air from the syringe and needle
5. Choose the site and clean it with an alcohol swab
6. Stretch the skin and inject into the chosen site by holding the syringe and needle at about a 90° angle
7. Draw back the plunger to check whether or not you are in a blood vessel. If blood returns, withdraw get a new needle, and re inject into a different spot If there is no blood, push the drug slowly into the muscle
8. When completed, withdraw the needle and gently massage the area to aid absorption
9. Place the patient in a comfortable position

10. Chart the time and procedure
11. Take care of equipment
12. Observe any reaction
13. Wash hands

**Quality criteria:**

**Performed:** performed the step or task according to the standard procedure or guidelines=2

**Partially Performed:** unable to perform the step or task according to the standard procedure or guidelines=1

**Not Performed:** step or task not performed by participant =0

LAP Test 4	Intra muscular medication
------------	---------------------------

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time started: \_\_\_\_\_

Time finished: \_\_\_\_\_

**Instruction I:** Given necessary templates, tools and materials you are required to perform the following tasks within 2 hours.

**Task:** Provide Intramuscular injection

Administer Diclofenac 75 mg IM for a patient suffering from pain

#### 4.6 Intravenous medication (injection)

**Objectives:** At the end of this lesson, the learner will be able to

1. Define an IV therapy
2. identify the necessary equipments
3. Mention the purposes of intravenous therapy
4. Practice the recommended intravenous therapy procedures

**Definition :** it is parenteral medication administration via which medications are given in catheters inserted into veins.

**Purpose:**

To get rapid effect (immediate effect)

For drug action in the blood stream or vessel

It is used in emergencies, like shock.

When the drug cannot be tolerated, if given by other routes.

For treating varicose veins

For diagnostic purposes

To supply nutrients to the body.

### **Types of intravenous injections:**

IV push

Intermittent infusion

Continuous infusion

#### **IV Push**

Is used to administer medications that must be given rapidly to have the desired therapeutic effect or those that are incompatible with IV fluids ( e.g. Phenytoin)

IV push medication may be given into a continuously infusing IV set or into a capped IV port (an intermittent infusion device or “heparin lock”)

IV push medications are usually given for at least 1 minute.

#### **Intermittent infusion**

Is used to administer medications that need to be infused for an intermediate length of time (usually, 30 minutes to 1 hr) and for those that are not stable for long periods.

Intermittent infusions of medications may be given when a client doesn't require continuous IV fluids. Medications administered by intermittent infusion are supplied in bags that contain 50 to 250 ml of IV fluid. These bags of fluid contain the medication dissolved in normal saline solution or in 5% DW.

NB: The nurse administering the medication is responsible for making sure that the medication supplied is the medication ordered; the medication, as ordered, is safe for the individual client; the IV catheter is patent and the medication is infused at the proper rate.

#### **Continuous infusion:**

is used to infuse medications that must be given continuously to achieve the desired effect (e.g. heparin or theophylline) or medications that are toxic if given over short periods (e.g. multivitamins)

#### **Precautions:**

Over dosage → results in poisoning & toxicity.

Renal impairment → clients with renal impairment shouldn't receive large IV dose.

Specific drug precautions

E.g. Prolonged IV administration of Quinine → hypotension

Infected /inflamed IV site → sepsis/ phlebitis

Cardiac disease→heart failure

**Contraindications:**

Heart block

IV site infection

Bleeding disorder

Restlessness of the patient

**Complications:-**

**Systemic**

Infection (sepsis)

air embolism

febrile reaction

speed shock

**Local:**

phlebitis

infiltration

**Sepsis:** is systemic infection of the body

**Cause**

Break in an aseptic technique when preparing or administering IV medication.

Contamination of IV catheter site when IV dressing is changed.

IV equipments changed infrequently

**C/M**

redness

warmth

pain

fever

↑sed leukocyte count

chills

**Nursing measures:**

Tape catheter securely to skin

Check catheter insertion site frequently

Change IV tubing of 48 – 72 hours.

**Infiltration:** is the entering of the fluid into the subcutaneous tissue.

**Cause:** - catheter migrated out of vein during client movement

**Nursing mgt**

Avoid placing IV catheter close to client's wrist or elbow whenever possible.

Tape catheter securely to skin

**Phlebitis:** is an inflammation of a vein.

**Causes:-**trauma to vein during catheter insertion or from catheter movement

Increased length of time of the catheter in vein

Infusing irritating substances

Using small veins or veins of the lower extremity where blood flow is slightly sluggish.

C/M

Pain, redness, & warmth along canulated vein

When palpated, vein feels hard.

Slow flow rate.

**Nursing MGT**

Discontinue and restart in another site.

Apply warm compress

Prevention:

Tape catheter securely to skin

Inspect IV site frequently

Avoid infusing irritating medications

Use larger veins

A void placing catheters near the wrist or elbow

### Sites of injections

- Peripheral veins – cephalic veins
  - basilic veins
  - Scalp veins
- } for childrer
- 
- Central veins- femoral vein
  - Jugular vein
- } for adults

### Essential equipments

The same as with other types of injection but including tourniquet and rubber sheet

### Steps of Procedure:

Wash hands and assemble and collect the equipment

Bring equipment to the bedside

Position the patient properly

Place rubber sheet and towel under his/her arm

Expose the arm and apply tourniquet

Ask the patient to open and close the fist

Palpate the vein and clean the site of injection with an alcohol swab

Hold the needle in line with the veins

Puncture the vein and draw back the plunger to check whether you are in the vein

Once you know that you are in the vein, release the tourniquet

Gently lower the angle of the needle until it is nearly parallel to the vein and instill the medication

Push the plunger very slowly

Check the patient all the while, no complaint should be ignored. If there is any reaction, stop the procedure

After all the drug is injected, remove the needle and apply pressure to prevent bleeding

Tell patient to apply pressure over the injection site

Watch the patient for few minutes before leaving

Remove equipment

Make sure the patient is in a comfortable position

Chart the procedure and any reaction

Take care of the equipments-sterilize,wash,and return to their place

Wash hands

### Quality criteria:

**Performed:** performed the step or task according to the standard procedure or guidelines=2

**Partially Performed:** unable to perform the step or task according to the standard procedure or guidelines=1

**Not Performed:** step or task not performed by participant =0

LAP Test 5	<b>Iv push mediation</b>
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time started: \_\_\_\_\_

Time finished: \_\_\_\_\_

**Instruction I:** Given necessary templates, tools and materials you are required to perform the following tasks within 10 minutes.

Task Performing intravevus injection

#### **4.7.Intravenous infusion**

**Objectives :** At the end of this topic the trainees will be able to

Define intravenous infusion

List indication for intravenous infusion

List contraindications for intravenous infusion

Identify necessary equipments

Re demonstrate the procedure

**Definition :** - is infusion of a fluid into a vein to prevent or treat fluid or electrolyte imbalance or to deliver medications or blood products.

**Purpose:-**To supply the body with fluid when oral fluids are not tolerated.

To supply the body with nutrients in the form of glucose, AAs, electrolytes, whole blood, etc.

To dilute poisons, and to flush out kidneys.

To force dilute poisons, and to flush out kidneys

To force diuresis

To provide an access route to administer medications intravenously.

**Types of solutions:**

IV solutions can be

*Isotonic fluids:*

have the same osmotic pressure as that found within the cell  
used to expand the intravascular compartment and thus ↑se circulating volume.  
do not alter serum osmolarity  
are helpful for hypotension caused by hypovolemia.

E.g- Normal saline (0.9% NaCl)

- lactated Ringer's solution
- 5% DW

*Hypotonic fluids:*

- have less osmotic pressure than the cell  
when these fluids are infused, they lower serum osmolarity, causing body fluids to shift out of the blood vessels and interstitial space.  
used for cellular hydration.

E.g. - 0.45% NaCl

- 5%DW can also be used as hypotonic fluid after the dextrose is metabolized.

*Hypertonic fluids:*

have greater osmotic pressure than the cell  
When a hypertonic solution is infused, it raises serum osmolarity pulling fluid from the cells and the interstitial tissues into the vascular space.

E.g. - 3% saline

- 5% saline
- 5% DW with normal saline
- 5% DW with lactated Ringer's solution
- Higher concentration of dextrose such as 50%DW

***Calculating flow rates of IV infusions:***

the drip rate of IV infusion can be calculated as:



$$\frac{\text{Drop}}{\text{Min}} = \frac{(\text{Total volume inf used})(\text{drop factor})}{\text{Total time for inf usion in min utes}} \quad \text{OR}$$

$$\frac{\text{drops}}{\text{min}} = \left( \frac{\text{Total volume inf used}}{\text{total time for inf usion in hours}} \right)$$

E.g. if 100 ml of 5% D/W is ordered to run in 24 hrs, how many drops per minutes should run?

$$\frac{1000\text{ml} \times 15\text{gtt} / \text{ml}}{24 \times 60 \text{ min}} = \frac{1000 \times 15\text{gtt}}{24 \times 60 \text{ min}} = 10\text{gtt/min}$$

### **Regulating flow rates of IV infusions:**

The flow rate of the infusion can be adjusted using the roller clamp until it corresponds with the prescribed rate of flow. And it needs to be monitored to confirm that the infusion is progressing at the ordered rate.

### **Factors affecting the flow rate of IV infusion:**

Height of the IV bottle

The position of the extremity

Kinking of the IV tubing

The position of the needle with in the vein

Patency of the catheter

Diameter of the tubing and needle/canula

Length of the tubing

Viscosity of the solution

Clogged air vents.

Operation Sheet 6	Administering intravenous infusion
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### **Equipments:**

IV fluid as ordered

Sterile syringe & needle

Rubber & towel

Receiver

Alcohol swabs

Arm board

Bandage& scissors

Tourniquet

I.V. Pole

Adhesive tape

Medication chart

### ***Preparation of the patient***

Since and infusion therapy takes several hours to complete, the patient should first be made conformable

### ***Steps of Procedure***

Identify the right pt.

Take equipment to the patient's bedside

Explain the procedure to the pt.

Remove air from the tubing

Place rubber & towel under the arm

Apply tourniquet about 3 cm above the intended site of entry

Observe & palpate for suitable vein

Cleanse the skin with alcohol swabs thoroughly& retract down the vein & soft tissue 4 cm below intended site of injection.

Hold needle at 45<sup>0</sup> angle line with the vein

Pierce the skin and puncture the vein

Check if you are in the vein by drawing back of the plunger of the syringe, ( blood returns if you are in the vein )

Release the tourniquet gently

Start the flow of solution by opening the clamps

Support needle with sterile gauze or sterile cotton balls

If necessary to keep it in proposition in the vein

Anchor the I.V. tubing with the adhesive tape to prevent pull on the needle

Place arm board or splint under the arm and bandage around

Adjust the rate of flow

#### NOTE

The arm board should be long enough to extend beyond the wrist and elbow joint.

Board should be padded

Infusion bottle should be labeled with the date time infusion is started drops, per minute and any added medication, if more than one bottle as used in 24 hrs, it should be labeled as bag 1,2,3, and so on.

Extend the arm in the most comfortable position

5. Usual areas used for intravenous infusion are

The median basilica vein of the inner surface of arm

A vein on top of the foot

In an infant the jugular vein and the scalp vein

#### *Nursing responsibility*

Checking the order to determine the correctness (e.g. the volume of the solution to be infused, the rate of flow per hour, any additives to the solution)

Preparing the client by teaching about the type of the therapy ordered, and the role that he/she will play in maintaining therapy

Selecting and preparing the site with 70% alcohol

Performing the venipuncture.

Securing the venipuncture device

Monitoring intravenous infusions

Maintaining intravenous therapy

#### **Quality criteria:**

**Performed:** performed the step or task according to the standard procedure or guidelines=2

**Partially Performed:** unable to perform the step or task according to the standard procedure or guidelines=1

**Not Performed:** step or task not performed by participant =0

LAP Test 6.	<b>Iv infusion</b>
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time started: \_\_\_\_\_

Time finished: \_\_\_\_\_

**Instruction I:** Given necessary templates, tools and materials you are required to perform the following tasks within 30 minutes

**Task:** Administer D/W the for a patient with physician prescription of  
of 5% D/W to run in 24 hrs

#### 4.8. Blood transfusion

**Objectives:** at the end of this topic, the trainees will be able to:

Define blood transfusion

Identify the purpose of blood transfusion

Identify blood group

Define blood compatibility

List blood transfusion reaction

Re demonstrate the operation

**Definition :** It is infusion of one person's whole blood or its components into the blood vessels of another, i.e. from donor to recipient.

#### **Purpose:-**

To increase blood volume and blood pressure during hemorrhage, trauma, or burn

To prevent shock especially during major surgery

To ↑se oxygen carrying capacity in anemia

To provide antibodies, and leukocytes in severely ill patients

To correct deficiencies of plasma proteins, clotting factors and hemophilic globulin, etc.

To combat infections in patients with leucopenia

#### **Blood groups and types**

Based on the type of antigen(s) present on their erythrocytes, individuals can be divided into 4 ABO blood groups: types A, B, AB and O. That is

Blood group	Antigen	Antibodies	Donate	Receive
A	A	Anti- B	A, AB	A, O
B	B	Anti- A	A, AB	B, O
A, B	A, B	-	AB	A, B, AB, O
O	-	Anti- A & Anti B	A, B, AB, O	O

-As each person has antibodies in his blood, which react with foreign body proteins in the blood cells of another person, causing agglutinations or clumping of the red blood cells, blood test must be performed before transfusion.

#### **NB:-**

Individuals with blood group O are universal donors b/c they don't have any antigen A and B

Individuals with blood group AB are universal recipients b/c they have neither of the anti A, and anti B antibodies.

Types of blood which get agglutinated in the transfusion is said to be incompatible.

#### **Rh Compatibility**

Based on the presence of antigen D on the surface of their erythrocytes, individuals can be Rh<sup>-ve</sup> or Rh<sup>+ve</sup>, that is individuals with antigen D are Rh<sup>+ve</sup> where as individuals with out antigen D are Rh<sup>-ve</sup>

If Rh<sup>+ve</sup> blood is transfused to an Rh<sup>-ve</sup> individual, the Rh negative blood cells produce antibodies to destroy the transfused cells. The effect of a first transfusion may be slightly effective but the individual becomes sensitive to the D factor and further transfusion, with Rh positive blood, may produce fatal reaction. Thus, Rh factor must be determined before transfusion to prevent blood incompatibility.

#### **Blood components**

The client doesn't always need all components of whole blood, so certain blood components can be selectively transfused depending on the clinical needs of the client.

Common blood products for transfusion include:

***Whole blood:***

Contains all blood components and is usually transfused to people who need both blood cells and volume replacement

Used to treat hypovolemic shock 2<sup>0</sup> to hemorrhage

Not indicated for the management of anemia.

***Packed red cells:***

are red cells separated from whole blood by centrifuging /sedimentation

Indicated for chronic anaemia

.safer in CHF

Contain less volume and less Na<sup>+</sup> & K<sup>+</sup>. Thus, problems of fluid overload and electrolyte imbalances can be avoided by using the packed red cells.

***Platelets***

Used to initiate blood clotting, and hemostasis.

Indicated for clients with thrombocytopenia & hemorrhage.

***Whole plasma:***

Used to correct hypovolemia due to selective loss of plasma, such as occurs in extensive burns.

Electrolyte solutions and albumin often can replace it.

Indicated for patients with bleeding disorder due to coagulation factor deficiency

***Albumin:***

Used as a volume expander, b/c fluid is pulled back in to the vasculature due to the oncotic pressure (force) the protein exerts.

Unlike whole plasma, albumin carries no risk of hepatitis transmission.

Indicated to administer for clients with hypovolemic shock and hypovolemia

***Cryoprecipitate:***

Is a plasma fraction rich in fibrinogen and blood clotting factor VIII.

Is used to treat hemophiliacs, who are predisposed to bleeding problems b/c genetically they lack factor VIII.

Operation Sheet 7

Blood transfusion

***Equipments:***

Bottle containing blood, with the patient name, blood group and RH. Factor

Blood giving set

Sterile forceps in a sterile jar

Sterile syringes and needle

Alcohol swabs

Sterile gauze

Rubber sheet and towel

Tourniquet

Arm splint

Bandages and scissors

Adhesive tape

Receive for dirty swabs

I.V. Pole ( stand )

Patient's chart

***Steps of Procedure:***

Before blood transfusion is administered the nurse has to check the blood group & Rh factor, if cross match of the donor's & the recipient's blood is done and is compatible. Also check for HIV.

Prepare the tray with necessary items

Before taking it to the patient's room check the patient's name, hospital number, bed number, blood group, Rh factor and the expiration date with with a 2<sup>nd</sup> nurse or a doctor

Blood should be used with in 21 days of its withdrawal date

Take it to the pt's room

Explain procedure to patient

Hang the bottle & remove the air from the tubing

Put pt. in a comfortable position

Place rubber & towel under the arm

Check the vital sings before administering

Choose the vein

Apply tourniquet

Clean the skin & feel for a distended vein & clean again

Puncture the vein with the needle ( the needle here should be short and wide so that it does not cause occlusion easily)

After you make sure that you are in the vein release tourniquet & open the lamp.

The drop / minute at the beginning should be very slow

Watch patient closely for any reaction

If there is no reaction from the patient regulate the rate of flow according to the patient's conditions & the order.

Splint the arm & position it comfortably.

Remove the equipment you have used, wash and return to its proper place.

Record the time you started the blood& any other pertinent information

Check pt. frequently.

#### NOTE

Always remember to have anti-histamine injection ready in case a patient has reaction from the blood.

Be familiar with the most usual symptoms of blood reactions which are:-

#### ***Immediate reaction***

Headache

Backache

Chills

Pyrexia

Rash of the skin ( Urticaria )

#### ***Late reaction***

Dyspnea

Hematuria



Chest pain

Rigor ( Rigidity )

## **Complications**

Early complications:

### **Febrile reactions:**

Febrile reactions to blood products can occur b/c of the recipient's hypersensitivity to the donor's blood cells.

**C/Ms:** Fever, chills, headache and malaise

### **Nursing measures:**

Administer antipyretics, such as aspirin before blood transfusion

Stop the infusion and keep the IV open with normal saline if symptoms occur after the infusion has been started.

### **Allergic reactions:**

Allergic reactions may occur because the client has sensitivity to the plasma protein from the donor's blood.

**CMs:-** Flushing, urticaria (hives), wheezing and a rash with itching.

**Mgt:** - stop the infusion and keep the IV open with normal saline.

Antihistamines to ↓se the severity

### **Hemolytic reaction:**

Is the most serious acute complication which occurs when the donor's blood is incompatible with the recipient's blood.

When wrong blood is mistakenly administered to a client, hemolysis or destruction of red cells occur b/c the antibodies in the recipient's blood cells quickly react to the donor's blood cells.

**Symptoms:** facial flushing, fever, chills, headache, low back pain, tachycardia, dyspnea, hypotension and blood in urine.

### **Nursing measures**

Vital signs should be monitored before starting the infusion and during the first 5 minutes when the blood is infused slowly.

If hemolytic reaction is suspected, stop the infusion and keep the IV open with normal saline

Medical Measures:

Treat hypotension

### **Septic reactions:**

Septic reactions can occur if the blood products have been contaminated with bacteria.

Symptoms: Fever, chills, Vomiting diarrhea, and hypotension

Nursing measures:

### **Late complications:**

Delayed hemolytic reactions- usually occur at about 2 to 14 days and are recognized by fever, mild jaundice & a gradual fall in Hgb level. This reaction is not dangerous but early recognition is important for prevention of acute haemolytic reaction in subsequent transfusion.

Transmission of infectious diseases:

If donors are not carefully screened for diseases like jaundice syphilis, malaria, filarial, and AIDS, it may cause untoward reaction.

Circulatory overload: it is due to the rapid flow; also, it may occur by giving whole blood to the severe chronic anemic patient, and a patient with heart failure.

thrombophlebitis

pulmonary embolism

Infiltration.

### **General Nurse's responsibility in parenteral medication administrations**

check the order, d<sub>x</sub>, and name and age of the patient

check the indication for proper route for medication

Assess medical history and history of allergies.

Observe verbal & non-verbal responses of the patient toward receiving injection

Check the site of injection

Check the expiry date of medication and the form of medication available

Identify the patient by checking the name, age, and d<sub>x</sub>.

Check the nurse's record to find the time at which the last dose was given.

Stop the infusion

Prevention: keep blood products refrigerated.

**Quality criteria:**

**Performed:** performed the step or task according to the standard procedure or guidelines=2

**Partially Performed:** unable to perform the step or task according to the standard procedure or guidelines=1

**Not Performed:** step or task not performed by participant =0

LAP Test 7.	<b>Blood transfusion</b>
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time started: \_\_\_\_\_

Time finished: \_\_\_\_\_

**Instruction I:** Given necessary templates, tools and materials you are required to perform the following tasks within 30.minutes

**Task:** *Perform blood transfusion for a patient requiring 1 bag of whole blood to be transfused with in 24 horse*

#### 4.9 Topical medication

Objective: at the end of this topic, the trainee will be able to;

Define topical medication

Identify topical drug preparation

Re demonstrate the activities

**Definition** :-is the act of applying topical medications in to the surface of the skin or into the body cavities.

**Purpose**: - to obtain direct action at a particular site, although some systemic effect may also occur.

**Types**:-Skin applications

Eye instillations and irrigations

ear instillations and irrigations

nasal instillations

vaginal applications

rectal instillations

### **Skin application**

**Definition** :-is the act of applying a drug prepared in the form of powder ointment,creames,and oils or lotions on to the surface of the skin.

**Purpose**:-to treat local skin problems. It can also used to treat systemic problems

NOTE: Cleaning skin with soap and water and local heat when indicated increase absorption

### **Eye irrigation**

**Definition** :-is washing or flushing of the conjunctival sac by a stream of liquid

**Purpose**:

to prepare for ophthalmic surgery

to remove foreign particles

to apply heat or cold

-to prepare the eye for medication administration

**Position**:-supine position with slightly turning of the head to the side to be irrigated

**Solutions used**:

plain water

normal saline

boric acid, 2%, as an antiseptic

silver nitrate, 1%, as an antiseptic

acriflavin, 1%, as an antiseptic

NOTE:

The temp. of the solution should be about 98 to 100°F

Eye irrigation is a sterile technique

### Eye instillation

Definition :is the act of administering medications in to the orbital cavity

**Note**:-eye instillation is a sterile technique

### PURPOSE

To combat infection

To relieve pain and discomfort

Inflammations, or other problems of the eye

To dilate or constrict the pupil

Indications

Eye examination treatment of disease

Contraindications

Allergies to the medications

Operation Sheet 8	Administering intravenous infusion
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Equipment

Sterile solution of medication

Small gauze squares or cotton balls

Gloves

## Procedure

Nursing Interventions	Rationale
Check the patient's name	For proper patient identification.
Check physician's directives.	To avoid medication error.
Wash hands prior to instilling medication.	To prevent transfer of microorganisms to the patient.
Cleanse the eyelids and lashes with cotton balls or gauze pledgets moistened with normal saline.	Prevent debris to be carried into the eye when the conjunctival sac is exposed.
Use each cotton ball or pledget for only one stroke, moving from the inner to the outer canthus of the eye.	Prevents carrying of debris to the lacrimal duct.
Tilt the patient's head back slightly if he is sitting or place the head over a pillow if he is lying down.	To prevent solution or tear from flowing towards the other eye.
Fill eye dropper with medication but prevent from flowing back into the bulb end.	Loose particles of rubber from bulb end may slip into medication.
Using forefinger, pull lower lid down	To expose inner surface of lid and cul-de-

gently.	sac
Instruct patient to look upward.	Prevent medication from sensitive cornea.
Hold the dropper close to the eye but avoid touching the eyelids.	Touching the eyelids may startle the patient and cause him to blink.
Allow the prescribed number of drops to fall in the lower conjunctival sac but do not allow to fall onto the cornea.	It causes unpleasant sensation to the patient or may injure the cornea.
Release the lower lid after the drops are instilled. Instruct the patient to close eyes slowly, move the eye and not to squeeze or rub.	Squeezing or rubbing may irritate the eye tissue or would express the medication from the eye. Closing and moving the eye allow medicines to be distributed over the eye.
Wipe off excess solution with gauze or cotton balls.	Prevents possible skin irritation.
Wash hands after instilling the medication.  Decumbent the procedure	Prevents transfer of microorganisms to self or to other patients.

**Quality criteria:**

**Performed:** performed the step or task according to the standard procedure or guidelines=2

**Partially Performed:** unable to perform the step or task according to the standard procedure or guidelines=1

**Not Performed:** step or task not performed by participant =0

LAP Test 8	<b>Eye installation</b>
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time started: \_\_\_\_\_

Time finished: \_\_\_\_\_

**Instruction I:** Given necessary templates, tools and materials you are required to perform the following tasks within 10 hours.

**Task:** perform eye drop medication or install eye medication

### **Ear irrigation**

Definition: is the act of washing the external auditory canal with a stream of liquid.

Purpose:

To wash out impacted ear wax

to remove foreign bodies

To apply heat

To cleanse ear, in case of purulent discharge, caused by the middle ear infection

For antiseptic effect

### **Solutions used**

boric acid, 2-4%

soda –bicarbonate solution, 1%

normal saline

hydrogen peroxide

Plain water



**Position:**-sitting or lying position with the head tilted to wards the affected ear

## Ear instillation

Definition : is the act of administering medications in to the ear.

## Purpose

To clean the ear

To remove the foreign body or wax

To relieve inflammation, congestion and pain

To kill an insect lodged in the ear

To anesthetize

## General Instructions

Explain the procedure clearly to get patients cooperation

The auditory canal should be cleaned before instill the ear drops

Drops must be warm, when they are instilled into the ear

Hold the pinna of the ear upward and backward in case of adults and in children put it down backward to straighten the external auditory canal

Plug the ear with a small cotton ball or a small gauze piece

Allow 3 or 4 drops trickle down on one side of the canal so that the air may escape from the auditory canal and medication may reach up on the ear drum

Do not ignore any complaint by the patient

the temp.of the solution should be 98-100<sup>0</sup>F

both ear instillation and ear irrigation are sterile procedures

Operation Sheet 9	Application medication in to the ear
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## Equipment

A small tray containing

Medicine with dropper

Applicators with cotton tips

Normal saline

Little cotton

Kidney tray and paper bag

### Steps of Procedure

Wash hands and collect the articles and take it to the bedside

Explain procedure to the patient

Place the patient in supine or sitting position with head to side and the affected ear up

Pull the pinna down and back in case of adult and down and back case of infant/child. Rest the other hand on patients head to avoid damaging the ear with dropper if the patient moves

Instill the medicine drop by drop directing the flow toward the canal do not allow the dropper to touch the ear

6.Place loose cotton in the outer ear absorbs any excess medicine and keeps the patients head turned to the side for 10 to 15 minutes

7 .Place the patient comfortably

8. Replace the articles

9. Hand wash

10 . Record the procedure in nurse's record sheet

### Quality criteria:

**Performed:** performed the step or task according to the standard procedure or guidelines=2

**Partially Performed:** unable to perform the step or task according to the standard procedure or guidelines=1

**Not Performed:** step or task not performed by participant =0

LAP Test 9	<b>Ear instillation</b>
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time started: \_\_\_\_\_

Time finished: \_\_\_\_\_

**Instruction I:** Given necessary templates, tools and materials you are required to perform the following tasks within 2 hours.

**Task:** Perform ear instillation

## Unit Five: Monitoring and evaluating client response to administered medication

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

Monitoring client responses

Managing adverse reaction

Medication errors

Documentation

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, you will be able to::

Define monitoring and evaluation

Explain patient response to medication

Identify methods of patient monitoring and evaluation

Identify medication error

### Learning Instructions:

Read the specific objectives of this LearningGuide.

Follow the instructions described below 3 to6.

Read the information written in the information —Sheet 1, Sheet 2, Sheet 3, Sheet 4 Sheet 5and Sheet6

Accomplish the —Self-check 1, Self-check t 2, Self-check 3, Self-check 4. Self-check 5 and Self-check

Ifyouearnedasatisfactoryevaluationfromthe—Self-check||proceedto—OperationSheet1

Do the —LAP test|| in **page** – \_\_\_\_\_ (if you areready)

## 5.1 Monitor client responses

**Definition:** Monitor and evaluate client response to administered medication is assessing patient for effectiveness and adverse reaction of to patient to medication and respond to the reaction.

To monitor and evaluate patient response to medications

The nurse should have base line data by taking patient history and physical examination

Look for changes in vital signs and/or hemodynamic parameters (if available).

Hemodynamic change may be signs that patients are reacting to a medication.

For instance, if patient recently receive a beta blocker, he may notice a decrease in their heart rate and/or blood pressure.

Assess for any new signs and symptoms that the patient is experiencing:

This can be anything like itching, nausea or vomiting, constipation, and dry throat. Signs and symptoms of a severe allergic reaction, specifically, include difficulty breathing, hives or swelling, angioedema, syncope, and even hypovolemic shock.

In the event that the nurse is unsure whether a reaction is related to a medication, he can refer to his physician drug handbook, drug resource, or even his unit pharmacist

## 5.2 Managing adverse reaction

During one the event that the patient has developed a medication reaction, the nurse

Stop the medication if it's actively infusing, or in the case of an oral medication, withhold the dose.

Initiate a rapid response or code response, if the patient is unstable.

Notify the provider about the patient's response to the medication.

Provide an antidote, if there's one available. (For example, if the patient is experiencing an opioid overdose, the nurse can grab naloxone from the medication room to reverse the effects of the drug.)

Consult with the pharmacist, who may decide to either discontinue the medication order or switch the patient to another type of drug.

Draw a drug level, if toxicity is suspected.

If the patient is sustaining a mild reaction or side effect, give another medication to mitigate it. (For instance, if the patient feels constipated from taking a narcotic, the provider can offer a laxative.)

Document the medication reaction per hospital policy. If the patient was found to have an allergic reaction to a medication, the patient's allergies should also be updated in their medical record.

### **5.3 Medication errors**

A medication error is defined as "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare

#### **Most Common Prescription Drug Errors**

Lack of awareness of expiration dates. Although expiration dates are printed on the bottle or label, many provider do not pay attention to the date. ...

Taking the incorrect dosage. ...

Rate of usage. ...

What time of day to take the drug. ...

Combining drugs without physician guidance.

#### **Most Common Prescription Drug Errors**

When taken correctly, prescription drugs can improve a patient's quality of life, and reduce their likelihood of experiencing serious adverse events related to a certain condition. However, when taken incorrectly, prescription drugs can pose significant harm.

While some medication errors can be relatively harmless, some have the potential to be fatal, such as combining an opioid with a sedative.

According to an article published by Mount Sinai Medical Center, the top 5 common mistakes patients make with their prescription drugs are as follows:

### **1. Lack of awareness of expiration dates**

Although expiration dates are printed on the bottle or label, many patients do not pay attention to the date. When patients are unaware of when their medications expire, they may unknowingly put themselves at risk for experiencing problems related to safety or efficacy.

### **2. Taking the incorrect dosage**

Remembering specific directions for a prescription drug may be relatively simple for 1 drug, but when more are added to a regimen, patients are at an increased risk of not taking the drugs as prescribed, according to the article. This may be especially prevalent among elderly patients who have numerous comorbidities that each require drug therapy.

### **3. Rate of usage**

In light of the opioid epidemic, states are now creating various initiatives to prevent individuals from using prescription drugs at an inappropriate rate. Some patients with opioid misuse disorder may seek prescriptions from multiple physicians, or steal prescriptions from friends or family members.

### **4. What time of day to take the drug**

Certain prescription drugs must be taken at a specific time of day to have the optimal effect. If the drugs are not taken at the designated time, it may not elicit the desired effect. For example, Mount Sinai reported that cholesterol-fighting drugs should be taken at night to combat increased cholesterol production during that time of day.

### **5. Combining drugs without physician guidance**

Because many patients take vitamins, physicians should be informed of these supplements due to the potential for adverse events.

## 5.4 Documentation

**Definition:** Nursing documentation is the record of nursing care that is planned and delivered to individual clients by qualified nurses or other caregivers under the direction of a qualified nurse. It contains information in accordance with the steps of the nursing process.

Medical/nursing documentation is an instrument which helps the health care staff to record all information about patients' health status and the procedures provided by the hospital staff.

It is essential for good clinical communication. Appropriate documentation provides an accurate reflection of nursing assessments, changes in clinical state, care provided and pertinent patient information to support the multidisciplinary team to deliver great care.

Prescription orders and medication administration documented in patient records allow nurses and physicians, working across time and locations, to access relevant information at any point in time. Clear and concise medical record documentation is critical to providing patients with quality care, ensuring accurate and timely payment for the services furnished, mitigating malpractice risks, and helping healthcare providers evaluate and plan the patient's treatment and maintain the continuum of care.

Medication documentation contains

The drug, dose, the time, route, and any other specific information as necessary



Self- Check	Writing Test
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**Directions:** Answer all the questions listed below.

Define documentation

List purpose of documentation

Describe information included in the documentation chart

List medication error and discuss their preventive measures

-Each questions has a total worth of 5 marks

*Note:* Satisfactory rating -10points      Unsatisfactory - below 10 points

### Answer Sheet

Name: \_\_      Date: \_\_

Score= \_\_\_\_\_

Rating: \_\_\_\_\_

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