Pharmacology

- **Pharmacology:**
  - It is a Latin word meaning drug knowledge.
  - Pharmacou = drug.
  - Ology = science or knowledge.

- **Drug:** is defined by the United States food and drug administration as “a substance or agent used in diagnosis, cure, prevention, mitigation, or treatment of a disease or condition.”

- The FDA definition of drug also includes any substance listed in USP (the United States pharmacopia) and BP (British pharmacopia) and all substances other than food or devices capable of altering body structure.

- **Pharmacopia:** is a book containing formulas, which are standard for preparation and dispensation of drug.

**Branches of pharmacology**

1. **Pharmacotherapeutic:** (clinical pharmacology)
   It deals with relative effect of drugs in the human system for various disorders or it deals with the effect of a drug that the Dr. orders for treating a human patient “The study of drug action in man”.

2. **Pharmacodynamic:**
   Which deal with experimental (science pertaining to theories of drug action or it deals with the interactions between chemical components of living system and foreign chemical including drugs that enter living organism.
   “What the drug does to the body”

3. **Pharmacokinetics:**
   Which is the study of drug’s alteration during its way through the body or its the study of the fate of drug in the body as it is absorbed, distributed, bound to or localized in tissues, biotransformed and excreted.
   The science concerns itself with:
   1. Drug absorption and distribution.
   2. Drug plasma concentration.
   3. Therapeutic plasma levels.
   4. Concentration of the active drug at the target site.
   5. Rate of metabolism.
   6. Rate of excretion.
   These parameters in turn affected by:
   1. Physiochemical nature of the drug e.g. lipid solubility.
   2. Formulation of the drug.
   3. Route of administration.
   4. binding of the drug to plasma and/or tissue (bioavailability)
   5. Individual characteristics of the patient.
   6. Concomitant diseases.
   7. Concomitant administration of food or other drugs.

- **Sources of drugs:**
  Drugs and biologic products are derived from 4 main sources:
  1. Plants: examples of which are digitalis.
2. Animals and human: from which drugs such as insulin, epinephrine are obtained.
3. Minerals or mineral products: examples such as iodine and iron.
4. Chemicals: made in laboratories. They are pure drugs and some of them are simple such as sodium bicarbonate where others are complex synthesis such as sulfonamides and adrenocorticosteroids.

V Active constituents of plant drugs:
The leaves, roots, seeds and other parts of plants may be dried or otherwise processed for use as medicine and they are known as crude drugs.
On separation of these active constituents, the resulting pure form are:
1. More potent.
2. Usually produce effects more reliable than those of the crude drugs.
3. More poisonous and the dose must be smaller.
These active constitutes are:
1. Alkaloids: examples are atropine, morphine, codeine and heroine.
   They are toxic, has bitter taste, alkali-like, potent in small doses, insoluble in water (but its salts are soluble in water) and they usually end with “ine”.
2. Glycosides: Such as Digoxin.
3. Gums: Such as Agar.
4. Resins: they are fatty-like substances that are greasy and irritant such as cathartics.
5. Oils: they are 2 types:
   One) Volatile such as peppermint oil and clove oil.
   Two) Fixed such as olive oil and caster oil.

Common Drug Preparations:
1. Solutions and Suspensions:
   v Aqueous Solutions: have one or more substance dissolved in water e.g. Epinephrine nasal sol.
   v Aqueous suspensions: are preparations of finally divided drugs either intended for suspension or already in suspension in some suitable liquid vehicle.
   v Sterile suspensions are intended for intramuscular or subcutaneous injections but they can’t be given intravenously or intrathecally into spinal fluid.
   v Oral suspensions are NOT sterile and must NOT be injected.
   N.B.: - Suspensions tend to settle slowly and should be CHAKED WELL before use to provide uniform distribution of the drug.
   v Elixir: clear fluid containing water and alcohol designed for oral use, usually has a sweetener added.
   v Syrup: medication dissolved in a concentrated sugar solution.
2. Dosage Forms:-
   Capsules, controlled- release or sustained- release capsules, tablets, pills and troches are used to provide a drug or mixture of drugs into definite doses and avoid the inconvenience of preparing the dose from dry powder.
   -Capsules and coated tablets are a convenient way of giving drugs that have unpleasant taste.
Capsules:- are solid dosage form for oral use medication in a powder, liquid or oil form are incased in gelatin shell, capsule colored to avoid mistakes in product identification.

Tablet:- Powered dosage form compressed into hard disks or cylinders. In addition to primary drug, they contain binders (adhesive to allow powder to stick together) and disintegrates (to promote tablet dissolution).

NOTES
1- Some gelatin capsules and tablets may be coated with substances that resist the action of gastric juice so that will not disintegrate until they reach the alkaline secretions of the intestine.

2- Sustained – release dosage forms contain small particles of the drug coated with materials that require a varying amount of time to dissolve. This provides for a long continuous period of absorption and effect.

Pill:- Solid dosage form containing one or more drug. Recently, they were replaced by tablets.

Ampoules and vials:- Ampoules and vials contain powder or liquid drug usually intended for injection.

Disposable Syringes:- Disposable syringes containing single dose of drug preparations are widely used.

Large volume intravenous Solutions:- In glass, flexible plastic or semi-rigid plastic usually of 250, 500, 100 ml e.g. 0.9% sodium chloride.

Intermittent IV. Solution:- These solutions are similar to the I.V. solutions except they come in smaller volumes.

3- Additional Formulations:-

Drops:- are aqueous solutions that anesthetize, soothe or medicate eyes, ears, or nose.

Installations:- are aqueous solution instilled into the body cavities or wound and allowed to dwell there in contact with tissue.

Foams and aerosols:- are powders or solutions for spraying skin as topical anesthesia to soothe or protect or inhalation for bronchodilation.

4- Others:-

Lotions:- Liquid suspensions or dispersions used for external applications e.g. calamine lotion.

Creams:- aqueous and oily emulsions to soothe skin.

Ointments:- semisolid preparations of medical substances in some type of base such as petrolatum lanolin used for their soothing or bacteriostatic effect. Ophthalmic ointment: Are sterile (e.g. Synthomycin) ophthalmic ointment.

Pasts:- Ointment- like preparations suited for only external application. e.g. Zinc oxide past.

Suppositories:- are mixtures of drugs with a firm base that can be molded in shapes suitable for insertion manually or with an applicator into body cavity or orifice e.g. Aminophylline supp.

N.B. :- they should be kept cool.

Drug Absorption, Distribution metabolism and Excretion

Absorption:- Is the process that involves the movement of drug molecules from the site of entry into the body to the circulating fluid.

The process begins at the site of administration and is essential (to the subsequent processes, distribution, metabolism and excretion).
Absorption as a process varies according to the route of administration, dosage form and the dose of the drug.

Factors Affecting Drug Absorption:

1. Nature of the absorbing surface (cell membrane), through which the drug must traverse.
   - The drug molecule may pass through a single layer of cells (intestinal epithelium) faster than several layers of cells (skin).
   - Size of the absorbing surface.
   N.B.: The more extensive the absorbing surface, the greater the absorption and more rapid effect of the drug.

2. Blood flow to the site of administration.
   Rich blood supply (sublingual) enhances absorption where as, poorly vascular site (subcutaneous) delays it.
   For example, patient in shock may not respond to (IM) administration of drugs because of poor peripheral circulation.
   N.B.: Drugs injected (IV) are placed directly into the circulatory system.

   - In order to be absorbed drug must be in solution.
   - The more soluble the drug, the more rapidly it will be absorbed.
   N.B.: Chemicals and minerals that form insoluble precipitates in the GIT or drugs that are insoluble in water or lipids can’t be absorbed.
   - Parenterally administered drugs prepared in oily vehicle will be more slowly absorbed than drugs dissolved in water or isotonic sodium chloride.

4. Influence of pH :
   Drugs that are acidic (e.g. Aspirin) become relatively undissociated in an acidic environment such as the stomach. And therefore can readily diffuse across the membrane into the circulation. In contrast, a basic drug tends to ionize in the stomach acid environment and not absorbed through the gastric mucosa. The reverse occurs when the drugs are in an alkaline media.
   N.B.: The unionized drug is lipid soluble readily diffuses across the cell membrane, the ionized drug is lipid insoluble and non-diffusible.

5. Drug concentration:
   Drug administered in high concentration tend to be more rapidly absorbed than drugs administered in low concentration.
   In certain situations, drug may be initially administered in large doses that temporarily exceeds the body capacity for exertion of the drug. In this way the active drug levels are rapidly are rapidly reached at the receptor site.
   Once active drug level is established by such cumulating effects, smaller doses of the drug can be administered to replace only the amount of the drug excreted since the previous dose.
   N.B.: The initial dose temporary overloading doses of the drug are Priming or Loading doses, while the smaller daily doses are Maintenance dose.

Dosage form:
“Enteric coating” on drugs are used for the following reasons.
1- To prevent decomposition of chemically sensitive drugs to gastric secretions.
2- To prevent dilution of the drug before it reaches the intestine.
3- To prevent nausea and vomiting.
4- To provide delay action of the drug.

N.B. :- Capsules forms are absorbed more rapidly than tablets because the powder inside capsules affords a large surface area than the compressed tablets.

Distribution:--
Is defined as the transport of a drug in body fluids from the blood stream to various tissues of the body and ultimately to it’s site of action.
-Most of drugs distributed initially to organs that have rich blood supply as the heart, liver and kidney. Delivery of the drug to the viscera, skin and adipose tissue is slower.
- The distribution phase can be extremely slow for drugs that bind strongly to serum proteins, because the drug- protein complex in unable to pass out of the plasma.
“Hypoalbuminemia as in liver disease, burn and malnutrition may affect absorption and distribution of drugs”.

v Distribution barriers:--
Specialized structures which are made up of biologic membranes can serve as barriers to passage of drugs at certain sites in the body:-
1- Blood- Brain Barrier: (BBB)
- Is a special anatomic arrangement that aims to distribute only lipid-soluble drugs into the brain and CSF e.g. General anesthesia.
- Ionized drugs & poorly soluble in fat are barred from entry into the brain.
- Antibiotics that cross the BBB with difficulty can NOT be used for CNS infections.
  - The instillation of the drug INTRATHECALY to bypass the BBB and provides direct effect against bacterial bran infection.
2- Placental Barrier:-(PB)
Is the membrane layers that separate the blood vessels of the mother and fetus.
N.B.:- Tissue enzymes in the placenta have the ability to metabolize some agents (e.g. catecholamines) by inactivating them as they travel from maternal circulation to the embryo.
- Unlike BBB, the non-selective passage of drugs across the placenta to the fetus is well-established fact.

2 major types of drug effects occur in the fetus:-
1- In the first trimester:-
One type of drug may induce aberrant development of organs & systems during the formation of these structures. This is known as a teratogenic drug which is defined as “An agent that causes physical defects in developing embryo”.
2- The second type of drug affects the second half of pregnancy as well as
delivery, when respiratory depression may occur in the newborn because of it’s inability to biotransform & excrete the drug given to the mother.

**Biotransformation “Metabolism”**

Is a process that chemically inactivates a drug by converting it to a more soluble compound or metabolites for excretion from the body.

- Liver is the primary site of drug metabolism, but other tissues also may be involved in this process as plasma, kidney, lungs, and the intestinal mucosa.
- Chemical alterations produced by microsomal enzyme system located largely in the liver.
- By this process the drug is converted to more polar & more water soluble.

- **The process occurs by:-**
  1- **Conjugation reaction:** union of the polar group of a drug with another substance in the body.
  The conjugated molecule also becomes more polar & more water soluble, therefore more excretable.
  2- **Oxidation**- reduction reaction:-
  3- **Hydrolysis**

- These responses generally produce a loss in pharmacological activity and occasionally are referred as DETOXIFICATION reactions.

- **N.B.** :- Prolonged drugs metabolism may be expected in the following cases:-
  1- Liver disease.
  2- Renal problems
  3- Sever cardiovascular dysfunction.
  4- Infant with immature metabolizing system.
  5- Aged with degenerative enzyme function.

- **Cumulative drug effects** may be expected when drug metabolism is delayed which may be manifested as excessive or prolonged responses to ordinary doses of drug.

- **N.B.** :- First-Pass effect:- is an initial biotransformation of a drug, passing through the liver from the portal vein that produce a loss of pharmacologically active molecules.

**Excretion :**

Is the process by which drugs and pharmacologically active or inactive metabolites are eliminated from the body, so this process decreases the drug level in the body.

- **The routes of elimination are :-**
  1- Kidney:- The majority of drugs and/or their metabolites are excreted through the urine.
  2- Lung:- The gases and volatile liquids as general anesthetic are excreted across the lung in the expired air.
  3- Intestine:- Many agents are eliminated through the intestine in the feces by biliary excretion.
  4- Sweat and salivary glands (may cause skin rashes).
  5- Mammary glands … Transfer from mother to baby.
N.B. :- Because of renal disease, the risk of drugs accumulation and drug toxicity is increased.
Note that dosage is reduced for most drugs in the presence of impaired renal function “some drugs can’t be given”.

**Onset of action:-**
Reefers to the time interval between administration and notation of the first therapeutic effect. It depends on
1. The route of administration.
2. The characteristics of the drug.
3. The drug’s rate of absorption through various membranes.
4. The formulation of the dose.

N.B. :- The onset of action is especially variable after oral administration depending on the presence of food in the stomach, the motility of the GI tract and other factors.

**Peak of activity:-**
When the drug reaches it’s maximum effect-coincides often with peak serum concentration. Many drugs cause this peak to surpass the optimally effective level but the concentration can fall rapidly below this level as a result of biotransformation and excretion. This drop occurs especially often when a short acting drug is given initially or intermittently.
Example :- In treatment of diabetes, insulin with various lengths of action are mixed to keep insulin levels at a therapeutically effective level around the clock.

**Duration:** is the period between the administration of the drug and the excretion of the entire dose of that drug or its metabolites.

**Biologic Half-life (t 1/2):-**
The time in which half the drug has been eliminated is the biologic half-life or t1/2.
N.B. :- If no additional drug is administered, if takes two half-limes to eliminate 75% of the drug.
-It is an important concept in establishing dosage frequency

**Bioavailability:-**
It measures the concentration of the pharmacologically active substance at the target site and / or in the serum.
It is the function of :-
1. The drug itself.
2. The metabolism of the patient.
3. The rate at which the drug is liberated from its dosage form or from storage in the body proper.
Example:- many drugs bind to serum protein (albumin) from which they released gradually, others stored at specific site as bone (tetracycline).
Drug isn’t to be bioavailable if :-
1. Bound to protein or to any other substance that renders the drug permanently or temporarily inactive.
2. Not released from its dosage form or site of administration.
3. Partially or totally degraded.
Factors that influence drug dosage and action

It is important for the nurse to be oriented of the characteristic that modify cell conditions and therefore modify the activity of a drug. These characteristics include the following:

1- **Age**:
   - Children and elderly persons are highly responsive to drug.
   - Infants often has immature hepatic and renal systems and therefore incomplete metabolic & excretory mechanisms.

   **N.B.** :- Aged individuals may demonstrate different responses to drug therapy because of deterioration of hepatic and renal function which is often accompanied by concurrent disease process such as C.V.D. (cardiovascular disease).

2- **Weight**:
   - The greater the weight, the greater must be the dose.
   - However, body weight due to fat or edema fluid should not be taken into consideration.
   - For very lean and very obese individuals, drug dosage is frequently determined on the basis of drug/kg of body weight or body surface area.

3- **Sex**:
   - Females don’t always respond to the action of drug in the same manner as do men.
   - Women are usually smaller than men, which lead to high drug concentration if dosage is prescribed indifferently.
   - Female’s body is composed of higher % of adipose tissue than males, absorption rate of drug are slower in fatty tissue than in skeletal muscle, so the effect of drug will be more pronounced and prolonged.

   **N.B.** :- During pregnancy, lactation, and menstruation many drugs are stopped:
   - One) Aspirin: not used during menstruation as it increase blood fluidity.
   - Two) Those excreted in milk don’t given during lactation as penicillins.
   - Three) Uterine stimulant should be avoided during pregnancy as they may produce abortion such as prostaglandins.
   - Four) Drugs that might affect fetus and placenta.

4- **Time of administration**:
   - Drug is more rapidly absorbed when the GIT is free of food, while irritating drugs are more readily tolerated if there is food in stomach.
   - Body resistant to drug is generally greater in the early morning when the body is at its lowest point of physiologic functioning and conversely, the body is more sensitive to drugs effect during time of maximal activity.

5- **Pathologic state**:
   - Diseases alter the functional activity and accordingly its response to drug, e.g. sever pain tends to increase patient’s requirement to opiates.
   - The presence of circulatory, hepatic and/ or renal dysfunction will interfere with the physiologic process of drug action.

6- **Environmental Milieu**:
   - Drugs affecting mood & behavior are particularly susceptible to the influence of the patient’s environment.
   - With such drugs one has to consider effects in light of 4 FACTORS:
     - One) The drug itself.
     - Two) The personality of the user.
Three) The environment of the user.
Four) The interaction of these 3 components.
- Heat relaxes peripheral blood vessels while cold has the opposite effect.

7- Genetic factors:

Channels of Administration

1- The ORAL route:-(p.o.)
- The first and most convenient mean is the oral rout i.e. the patient usually swallows the drug, which then enters the gastrointestinal tract and absorbed from that area.

Advantages:-
- This route accounts for 80% of all medications administered to patients.
- Doctors usually decide the amount and frequency and the patient administer the drug to himself.
- The cost of medication and therapy is low.
- Oral administration is painless and there is no necessity to practice sterile technique.

Disadvantages:-
- Inconsistent absorption from the gastrointestinal tract.
- Blood level may very among different patients because of different GI characteristics e.g. acidity, gastric motility & intestinal mucosa.
- Drug irritation that causes nausea & vomiting.
- Unconscious patient & vomiting patients can’t be given the drug by this route.

2- Parenteral Route: -
The next most popular route of drug administration.
The word parenteral indicates that the drug is administered by a route other than enteral route (GI), common agreement has come to indicate the injectable route.

Advantages :
- Drugs that cannot be given through GIT.
- Eliminate the unpredictability of absorption from GIT i.e. the amount of drug will be delivered to the patient from injection site.
- Medication can be given to an unconscious patient.

Disadvantages :
- Need sterile technique.
- More expensive than oral preparations.
- Patient usually not able to medicate himself especially when medication needs to be injected deep into a muscle.
- Accidental penetration of blood vessel, especially if medication is not suitable for I.V. administration (complication).

There are a number of techniques for administering drugs by injection, these are related to the target area of the injection:

Subcutaneous Injection:-
SC injection is administration of a drug into the subcutaneous tissues.
- slowly drug absorption (advantage)
- Disadvantages:-
1-The most painful route.
3- Not effective in emergency (poor blood supply).

N.B. :- Drug absorption from SC injection can be reduced by:-
- Addition of vasconstrictor e.g. epinephrine.
- Application of cold packs (also vasoconstriction).
- Heat causes vasodilation which result in increased blood supply to the
  area and thus quicker drug absorption.
- This manipulation may be used to reduce the severity of toxicity from a
  SC injection.

**Intramuscular Route:- IM**
- Is the second most widely used route for injectable drugs.
- Suitable for administration of both solutions and suspensions.
- Drugs that are very water insoluble can be given IM in an oil base.
  (Remain for an extended period of time).
- Has greater vascular network than SC, so drug absorption is more
  quickly than SC route.
- Less painful (less nerve supply).

**Intravenous Injection :- I V**
- Administering a quantity of medication through a needle into the
  circulation.
- 2 methods of intravenous injection are used :-
  One) Administering the drug as a bolus.
  Two) Continuous infusion of a drug, which is called IV drip.

**Advantages:-**
1- To achieve highly, accurate and quick blood level.
2- A channel to administer drugs that irritate another sites e.g.
  chemotherapy.
3- Less painful during drug administration.

**Disadvantages:-**
1- Accidental overdose, and there is no way to withdraw the drug
  from circulation once it is injected.
2- Infiltrating the area around the vein i.e. needle slip out of the
  vein.
3- Thrombophlebitis from repeated injections. To minimize this
  phenomena (but doesn’t exclude it), drug should be given I.V. drip.
4- Inadvertent intra-arterial injection instead of a vein.

**N.B. :-**
IV solutions must be completely homogenous. No solution containing particulate
matter, regardless of how fine the particles should ever be injected IV because of
the danger of creating EMBOLI.

**Intradermal (ID) and Intrathecal administration:-**
- ID is a route of administration in which the drug is injected just below
  the epidermis.
- Injection is usually used for allergy test.
- Used for TB tests and for penicillin sensitivity test.

- Intrathecal route of administration involves inserting a needle between
  2 vertebrae and injecting the drug into the CSF.
- Used frequently in OR when anesthesiologist desires to produce a spinal block and inject local anesthetic directly into the spinal cord. Used to administer Chemotherapy to prevent CNS metastases of some types of cancers.

**Rectal, urethral and vaginal suppositories:**
Another route of administration that is quite useful when:
- The oral route can’t be used.
- The physician desires not to use the injectable route.
- When self-medication other than PO is desired, the rectal route of administration is used.

**N.B.:** Systemic effects can be realized by application of drugs to this area, as well as local effect.

**Disadvantages:**
- Erratic absorption from the rectal area result in an inaccurate predicted blood level of drug so the dosage must be adjusted.
- Rectal route is ineffective when the patient suffers from diarrhea.

**Examples:**
Rectal supp. ___ used to treat hemorrhoids.
Vaginal supp.____ used to treat vaginitis.
Urethral supp.____ used to treat bladder conditions.

**Topical route:**
- Are intended for use at the site of administration (there are exceptions e.g. Nitroglycerin ointment that is rubbed into the skin and systemic effect is achieved. – Two topical preparations are frequently confused with each other (ointment and creams).

1. **Ointments:**
- Are usually made up of a petrolatum type of base.
- They are quite greasy, as they intended for prolonged contact with the skin.
- They don’t disappear or penetrate the skin, but remain on the surface.

2. **Creams:**
- Made of viscous water-soluble chemicals, which usually disappear after being placed to the skin.
- Patient prefers cream to ointment, as creams don’t discolor clothing.

**Naming of drugs:**
1. **Generic name:** (chemical name), defines the chemical structure.
2. **Trade name:** is given by specific pharmaceutical company.

**How do drugs work?**
- In spite of a great deal of research, it is still not known how some drugs produce their effect, but it is possible to describe the way in which some of them act.

1. **The receptor theory:**
- It is believed that the cells in certain tissues contain structures (called receptors). These receptors combine with substances, which are produced naturally in the body.
The drugs stimulate the receptors which will cause the cells to be stimulated.
The contraction of muscle fibers produced by acetylcholine is an example.
The drug is thought to fit into a receptor rather as a key fits a lock. It may then either stimulate the receptor and produce an effect similar to that of the naturally occurring substance or it may occupy the receptor without producing any effect but preventing any naturally occurring stimulation to take place (the blocking of acetylcholine by atropine is a good example.

2- Antimetabolites:
These drugs closely resemble substances which are used by the cells for nutrition and when absorbed, the cells cannot use them and so fail to multiply.
The Sulfonamides which are used to stop the multiplication of bacteria are a good example.
They are very similar in structure to para-aminobenzoic acid and certain bacteria can’t distinguish between them, and absorb the sulfonamide so regeneration is stopped.

3- Enzyme Inhibitors:
Enzymes are substances that speed up many chemical processes within the body.
Some of these enzyme-activated processes are concerned with the transport of chemicals in and out of the cells. Certain drugs have the property of inhibiting their action and thus interfere with some of these processes.
Diuretics are a good example as normally salt and water is transported out of the renal tubule back into the body, but this action requires enzymes and if they are inhibited by a diuretic, salt and water are not reabsorbed and pass out of the kidney with a resulting diuresis.

4-Action on cell membranes:
The function of nerves and muscles depends on ions passing across the membranes surrounding these cells.
Certain drugs interfere with movement of these ions and thus prevent nerve or muscle function as demonstrated by local anesthetics which block impulses passing up a sensory nerve.

5-Cytotoxic Effect:
Drugs may be used to kill bacteria or malignant cells without undue damage to the patient’s cells. The way this is brought about varies between drugs.

These are just a few of the ways in which drugs may work. It is probable that all drug action depends on their interference with cell activity and when more is known about the processes within the cell, then more will be discovered about how do drugs work.

*Side effects and drug toxicity*

Drug Allergies:
Allergic responses to drugs occur in some patients and not in others.
It is an adverse response to a drug resulting from previous exposure to that drug or one closely related to it. So drug allergy is exhibited only after a second or subsequent exposure to the drug.

Allergic reactions to drugs differ from drug toxicity in the following ways.
1-The allergic reaction occurs in only a fraction of the population where as toxicity will occur in all individuals if the dose is high enough.
2. The allergic response is unusual in that a small amount of unsafe drug causes a severe reaction.
3- With allergy, the reaction is different from the usual pharmacological effect of the drug.
4- For an allergic reaction to occur the patient must have had a previous exposure to that drug or one closely related to it.

There are 2 types of allergic responses:-
1- Immediate reaction involving antigen and antibody resulting in the release of histamine.
   - In mild cases the reaction is limited to urticaria (wheals and itching of the skin).
   - In severe cases (anaphylactic reaction) characterized by circulatory collapse or asphyxia due to swelling of the larynx & occlusion of the airway passages.
   - Example:- many patients are allergic to penicillin.
2- Delayed reaction :
   - Occurring several days or even weeks after the drug has been administered.
   - Characterized by fever (drug fever), swelling of the joints, reaction may involves blood-forming organs and kidneys.

Treatment of anaphylactic reaction may include administration of :
1- Epinephrine
2- Oxygen
3- Antihistamines
4- Corticosteroids

Drug idiosyncrasies:-
Idiosyncratic reactions are defined as those that occur in patients who have a genetically determined abnormal response to a drug. Reaction may be excessive and unusual.
Example:- Succinylcholine, a muscle relaxant, usually is broken down rapidly by enzymes in the plasma and liver so that the effects of the drug last for only a few minutes. In few patients, a normal dose of this drug produces profound muscle relaxation and suppression of respiration, that may last few hours. Those patients have a genetic defect that produces unusual enzymes & succinylcholine is not broken down.

Drug Hypersensitivity:-
It occurs when the patient shows extreme sensitivity to an effect of the drug. The response is the usual pharmacological effect, however the effect is intense and exaggerated. A simple decrease in the dose may be sufficient to eliminate this type of reactions.

Drug toxicity :-
Excess dosage may be either accidental or intentional, results in an exaggerated response to this drug. It may be sever & may lead to respiratory depression. Cardio-vascular collapse and death may occur if the drug is not withdrawn and adequate treatment is instituted.

**General side effects:**
- Unpleasant or unwanted reaction to a drug is termed as side-effects.
- Dermatologic reactions “pruritis, urticaria, alopecia, granulumas, rashes, photosensitivity,….”
- Blood dyscrasias: in certain patients, bone marrow is sensitive to certain drugs, this may result in the insufficient production of platelets, red blood cells & white blood cells.

**N.B.** :- Patients who receive a drug that may cause bone-marrow depression are monitored closely by frequent blood counts & for early signs & symptoms of infection.

Some forms of blood dyscrasias:-
1. Agranulocytosis.
2. Aplastic anemia → Panclytopenia (reduction of all formed elements of blood).
3. Hemolytic anemia.
4. Thrombocytopenia. (platelets deficiency)→ hemorrhage.
   - Hepatotoxicity. (Liver damage)→ Abdominal pain & jaundice.
   - Nephrotoxicity. (Kidney damages). → hematuria, anuria, proteinuria, edema & uremia.
   - Ototoxicity (ear damage) → damage of vestibular or/and auditory portion of the 8th cranial nerve.
   - CNS toxicity → loss of judgement, loss of movement coordination less of consciousness,Convulsions, tardive dyskinesia reduce knee-jerk reflex…
   - GI disturbance → nausea, vomiting, abdominal pain, diarrhea…..
   - Drug dependence → characterized by the appearance of physical symptoms when the administration of drug is discontinued.
   - Sexual dysfunction → change in libido.

*Drugs orders and prescriptions*

**Prescription :-**
- Medicating a patient begin when the medication is suggested and authorized by a legal prescriber, usually a licensed physician, dentist or veterinarian.

**It consists of 4 parts :-**

1. **The superscription:**
   - Which includes the patient name, address, date and the symbol Rx.
   - The age of an infant or a child should be written to permit the pharmacist to check the correctness of the dose.

2. **The inscription:**
   - Which states the name of the drug, dosage form, and the amount.

3. **The subscription:**
   - Which contains the directions of the pharmacist, now usually limited to the number of the doses to be dispensed.
4- The signature:-
Which abbreviated by “S” or “Sig” and means write on the label.
This indicates the directions for the patient who is to take the medicine and
instructions for refilling the prescription.

On of other hand the prescribers order has several elements that
should be presented and identified:-

1- Patient’s name and other identifying data.
2- Date that the order was written.
3- Medication name.
4- Dosage to be administered each time.
5- Route of administration.
6- Frequency of administration and special instructions.
7- Prescribers signature.

Example :-
Name :- ………………… age :- ……………
Address :- ……………… Date :- ………….
Rx
Erythromycin tab. 250 mg enteric coated
# 40
1 Tab. 9 6 hr, p.o.

Signature

* Types of orders *

It is probably obvious, that outpatients are free to medicate themselves with
any accessible medication.

Once an individual is admitted to a clinical institution, usually neither the
patient nor the nurse may legally administer any medication without a written
order.

Use of variant or non-standard abbreviations should be avoided because of
the danger of misinterpretation.

1. Routine Order :-
The most common type. It means that the drug as ordered to be
regularly administered until a formal discontinuation order is written, or until
a specified termination date is reached.
Automatic termination or stop may be explicit in agency policy.
e.g. Antibiotics 5 days, steroids 7 days ………
The policies act as stimulus to the prescriber to evaluate continued
need for these drugs that require especially close attention.

2. Single Order :-
Drug is to be administered once at the time indicated.
e.g. a preoperative medication (Atropine) 0.1 mg IM on call to OR.

3. Stat Order :-
This is a single order that drug is to be administered immediately.
Stat orders are written often for emergency when the client’s condition
change suddenly.
Example:- Give Aprisoline 10 mg IM stat.

4. prn Orders :-
These drugs to be administered by the nurse as necessary within the order criteria specified by the doctor order, the decision of when to medicate is left to the nurse judgment. Medications to reduce the perception of pain make up the bulk of Prn orders. Keep nursing assessment of the pain is required to carry out these Prn orders appropriately. The PQRST method is one that may be used to give the nurse in asking patient questions to elicit essential facts.

**P** … Precipitating & palliating factors “what brings & what relief it”
**Q** … Quality of the pain “how would you describe the pain”
 Burning, stabbing, squeezing…… .
**R** … Region & Radiation “where is the pain ….
**S** … Severity .
**T** … Time factor … How does the pain occur, How does it last . . .

**5. Telephone order and verbal order:**

- Usually given in emergency and should be written in the patient’s chart and assigned by the nurse who receive the order and to be signed by doctor as soon as possible.

**Disadvantages :-**
1) Forgotten if not written at that time.
2) It is illegal until the order is signed for by the prescriber.
3) Can easily be miscommunicated, misinterpreted or not clearly heard.

**General Guidelines For Handling Medications**

1. When preparing or giving medicines, concentrate your whole attention on what you are doing.
2. Make certain that you have a written order for every medication you will dispense.
3. Read the label before taking, using and returning the drug to it’s place.
4. All medicines should be labeled and the label should be clear.
5. Never give medicine from unlabeled container.
6. Measure quantities and calculate doses as ordered in proper way.
7. Handling tablets, capsules and pills properly and DO NOT touch with fingers. Use the cap of the container to guide or from the container to the cup directly.
8. Avoid wastage of medicine.
9. Never administer medications prepared by another person, otherwise you will bear the responsibility of any mistake.
10. Some preparations as insulin, vaccines & suppositories need to be kept in the refrigerator “2-8 c ”.
11. Stay with the patient until he takes his medicine.
12. All mixtures should be made immediately before use.
13. NEVER return unused drug to a stock bottle.
14. Don’t add any drug to the blood, interactions may occur without visible changes.
15. Don’t use any sterile article become unsterile by any way.
16. Don’t use clear solutions which has became cloudy or has a sediment.
17. Don’t use a drug that is out date.
18. Don’t use a drug that has change its color.
19. Don’t use a drug which arise doubt in mind.
20. All medicines should be kept in cupboard, NARCOTICS in a locked one.
21. Narcotics has a rule controlling their ordering, giving, and their registration.
22. Many liquids should be diluted with water or other liquids. “this is especially when medicine has a bad taste”.
23. Exception to this rule, cough medicines are not diluted, or the patient not allowed to drink water after taking cough syrup.
24. Don’t leave a tray of medicines unattended. If you are in a patient’s room and must leave, take the tray with you.
25. Never chart a medicine as having been given, until it has been administered.
26. Follow up the five rights
1. Right patient.
2. Right drug.
3. Right dose.
4. Right route of administration.
5. Right time.

*Commonly used abbreviations*

- a.c. = before meals
- alt. hor. = every other hour
- A.M. or a.m. = morning
- Aq = water
- a.u. = each ear, both ears
- a.d. = right ear
- a.l. = left ear
- b.i.d. = two times a day
- BUN = blood urea nitrogen
- c = with
- Caps = capsules
- CHF = congestive heart failure
- cm = centimeter
- COPD = chronic obstructive pulmonary disease
- d = day
- dc = discontinue
- dl = deciliter
- dr = dram
- elix. = elixir
- necessary
- g(gm) = gram
- gr = grain
- gtt = a drop, drops
- GU = genitourinary
- H, hr = hour
- h.s. = at bed time
- IM = intramuscular
- day
- mg = milligram
- mcg = microgram
- mEq = milliequivalent
- ml = milliliter
- NG = Nasogastric
- ng = nanogram
- NPO = nothing by
- o.d. = every day
- O.D. = right eye
- o.h. = every hour
- o.s., o.L. = left eye
- os = mouth
- o.u. = each eye, both eyes
- oz. = once
- p.c. = after meals
- p.o. = by mouth
- P.R. = by rectum
- per = by, through
- prn = when
- q = every
- q.d. = every day
- q.h. = every hour
- qhs = every night
- q2h = every 2 hours
- qid = 4 times daily
- qod = every other
I.V. = intravenous  \(\textcircled{R}\) = right
Kg = kilogram  Rx = symbol
for a prescription
L = liter  s = without
Min = minute  SS = one-half
Sc = subcutaneous  Syr = syrup
SL = sublingual  stat = immediately
SOS = if necessary once only  tab. = tablet
daily  t.i.d. = 3 times
Mg = microgram  U = unit
V.O. = verbal order

\[\text{Tolerance}\] = Decrease physiologic response to the repeated administration of a drug or chemically related substances which necessitates increase in dosage to maintain a given therapeutic effect e.g. morphine.

\[\text{Dependence (addiction)}\] = When the body is getting used to function in the presence of certain drug. The body will not perform its normal functions in the absence of that drug.

\[\text{Substitute}\] = These are many different drugs which may be used to treat a single disease. From these drugs, always present a drug of choice, if not available the others are considered as the substitute.

\[\text{Antidote}\] = a drug used to antagonize the toxic effect of another drug and to neutralize it’s symptoms.

*dosage calculation in pediatric*

1- **Clark’s rule** :- weight in pounds \(\times\) adult dose = child’s approximate dose.

\[
\frac{150}{1}
\]

2- **Young’s rule** :- Age in years \(\times\) adult dose = child’s approximate dose.

\[
\frac{\text{Age in years}}{\text{Age in years} + 12}
\]

3- **Fred’s rule** :- (for infant under 1 year) =

\[
\frac{\text{Age in months}}{150}
\]

4- **Clark’s body area rule** :-

\[
\text{body surface area (in m}^2\text{)} \times \text{adult dose} = \text{child’s approx. dose}
\]

\[
\frac{1.73}{1}
\]

\[
\text{surface area in m}^2 = \frac{7 \text{ X age in years} + 35}{100}
\]

or ……………… = \(4 \times (\text{weight in kg}) + 7\)

\[
\text{weight in kg} + 90
\]
weights & Measures *

1 kg = 1000 gm  
1 mg = 1000 mg  
1 mg = 1000 Mcg  
1 L = 1000 ML  
1 teaspoonful = about 5 ml  
1 tablespoonful = about 15 ml  
1 drop = 1 minim  
1 ml = 15 minims  
1 pound (lb.) = 454 gram  
1 kg = 2.2 Libra (lb.)  
1 gm = 15 grains

* Anti – infectives*

Introduction:-

The beginning of modern medicine is generally related to 2 events:-

1- The proof by Pasteur that many diseases are caused by microorganisms.
2- The discovery of effective anti-infective drugs.
   - sulfonamides (1938).
   - Penicillin (1940).

Some of the bacteria and other microorganisms have adapted to the anti-infectives and these have been gradual resistant to certain antibiotics.

Most resistant strains can be eradicated by:-

1- New and/or different antibiotics.
2- Antibiotic combinations.
3- Higher dosages.

Awareness of the problem has prompted somewhat greater scrutiny by the physician as to when and how to prescribe antibiotics.

Anti-infective drugs can be divided into:-

1- **Bacteriostatic:** arrest the multiplication and further development of the infectious agent.
2- **Bactericidal:** eradicate all living microorganisms.

Some anti-infectives halt the growth or eradicate many different microorganism and are termed as **broad-spectrum antibiotics.** Others affect only certain specific organisms and are termed **narrow-spectrum antibiotics.**

Some of anti-infectives elicit a hypersensitivity reaction in some persons. some Penicillins cause more sever & more frequent hypersensitivity reactions than other drugs.

N.B. **Antibiotics** = is drugs produced by microorganisms or other live organisms to kill other microorganisms, it could be produced synthetically.

Because of differences in susceptibility of infectious agent to anti-infectives, the sensitivity of the microorganism to the drug ordered should be
determined before treatment is initiated. Several sensitivity tests are commonly used for this purpose. e.g (Culture and sensitivity).

Certain anti – infectives have marked side-effects (some are serious) e.g. neurotoxicity, nephrotoxicity & ototoxicity.

Another difficulty is that these drugs can eradicate the normal flora in the intestine which are necessary for proper digestion, synthesis of vitamin K and control of fungi that may gain access to the GIT (super infection).

Action :- The mechanism of action of the anti-infectives varies. “will be discussed individually”.

Uses of ant-infectives:-

A: Prophylactic
1- To protect persons exposed to a known specific organism.
2- To prevent secondary bacterial infections in acutely ill clients suffering from infections unresponsive to antibiotics.
3- To reduce risk of infection in clients suffering from chronic illness.
4- To inhibit spread of infection from a clearly defined focus as after surgery or accidents.
5- To sterilize the bowel or other areas of the body in preparation for extensive surgery.

B. Acute infections: antibiotics are used to treat acute infections such as tonsillitis and acute upper respiratory tract infections.

Contraindication: allergy or hypersensitivity reaction.

Nursing considerations :-
- Check expiration date on container.
- Check for recommended method of storage.
- Clear mark the date & time of reconstitution, your initials and the strength of the solutions of all drugs. - Note the length of time that the drug may be stored after dilution and store under appropriate condition.

Aminoglycosides

Are broad – spectrum antibiotics primarily used for the treatment of serious gram negative infection caused by Pseudomonas, E.coli, proteus and klebsiella.

It distributed in extracellular fluids, cross the placenta barriers but not the BBB.

N.B. :- Penetration of the C.S.F. is increased when the meninges are inflamed.

Are excreted largely in the urine, so it is suitable for urinary tract infections.

Are powerful antibiotics that can induce serious side effects.

Action :-
They are believed to inhibit protein synthesis by binding irreversibly to ribosome which leads to production of nonfunctional protein. They are usually bactericidal as a result of disruption of bacterial cytoplasmic membrane.

N.B. :- They are poorly absorbed from the GI tract, therefore are usually administered parenterally.

Uses :-
Gram negative bacteria causing :-
1- Bone and joint infections.
2- Respiratory tract infections.
3- Septicemia (including neonatal sepsis).
4- Urinary tract infection (UIT).
5- Post operative infections.
6- Intra –abdominal infections (as peritonitis).
7- Skin infections (including burns).

N.B. :- It should be used for gram +ve bacteria only when other less toxic drugs either ineffective or contraindicated.

**Contraindications :-**
- Hypersensitivity to aminoglycosides.
- Long –term therapy “except streptomycin for tuberculosis”.
- For patients with impaired renal function or pre-existing hearing impairment.

**Side effects**
- Otorhinolaryngology: tinnitus , hearing impairment, ataxia & dizziness.
- Renal impairment (Nephrotoxicity) hematuria, proteinuria…….
- Neurotoxicity: headache, tremor, lethargy, numbness, burning of face.
- Others: nausea, vomiting, skin rash & superinfection.

**Drug interactions :-**
- Vancomycin additive: ototoxicity & nephrotoxicity.
- Penicillin effect of aminoglycosides.

**Nursing considerations :-**
- See anti-infectives.
- IM admin. inject deep into muscle to minimize pain.
- Admin. for only 7-10 days.
- Assess history of hypersensitivity.
- Obtain lab. studies for renal function.
- Continue to monitor for ototoxicity.
- Discuss with the client / family the importance of taking medications at the appropriate prescribed time intervals.

**Examples : -**
1) **Amikacin Sulfate :-**
   - **Trade name :-** Amikin.
   - **Classification :-** Antibiotic, aminoglycoside.
   - **Dosage :-** IM (preferred) I.V. adults, children 15 mg/ kg / day in 2-3 equally divided doses q 8-12 hr for 7-10 days.
   - Newborns loading dose, 10 mg/ kg followed by 7.5 mg/ kg q 12 hr.

2) **Gentamycin Sulfate :-**
   - **Trade name :-** Garamyein.
   - **Class :-** antibiotic, aminoglycosides.
   - **Dose: adults: 3 mg/kg/day divided into equal 3 doses q 8 hrs IV or IM.
   - **N.B.** It is the drug of choice for hospital- acquired gram negative sepsis including neonatal sepsis.
   - **Side effects** blood pressure, alopecia
- CNS: ototoxicity, tenitis, dizziness, ringing in the ears, vertigo.
- GI: nausea, vomiting, anorexia, weight loss, increased salivation.
- C.V.: palpitation, hypotension or hypertension.
- Hematologic: Decrease number of blood cells.
- GU: nephrotoxicity
- Local: Pain and irritation at IM injection site.

**Formulation:**
- Vial 2 ml containing 20 mg.
- Ampoule 2 ml containing 80 mg.

**Dosage:**
- IM (usual): I.V. adults 3 mg/kg q 8 hr up to 5 mg/kg daily.
- Children 2-2.5 mg/kg q 8 hr.
- Newborns 2.5 mg/kg q 12 hr.
- Ophthalmic solution 0.3%, 1-2 drops q 15-30 minutes.
- Topical ointment 0.1%, 1-5 times daily to the affected area.

**N.B.** should not be mixed with other drugs for parenteral use.

**Nursing implication:**
- When given IM, give it slowly and deep in the muscle.
- Dilute dose when given IV.
- Monitor for kidney function tests, complete blood count when used for more than 7 days. Consult with Dr. accordingly.

3) **Neomycin Sulfate:**

**Class:** antibiotic, aminoglycoside.

**Action:** Neomycin is an aminoglycosides antibiotic which is poorly absorbed from the BI tract, following oral administration, the growth of most intestinal bacteria is rapidly suppressed.

**Indications (uses):**

**A. P.O**
1. Diarrhea due to enteropathogenic E.coli.
2. Suppression of intestinal bacteria for short-term therapy prior to intestinal surgery.

**B. Topical**
- Inflamed skin conditions, burns.

**Add. Contraindication:** intestinal obstruction, pregnancy.

**Add. Side effects:** steatorrhea & electrolytes imbalance (mal-absorption).

**Formulation:** Tablets 500 mg.

**Dose:** 15 mg/kg/day IM in divided doses.
- Oral for hepatic coma: 4-12 g/d in divided doses for 5-6 days.

4) **Streptomycin Sulfate:**

**Class:** antibiotic, aminoglycosides

**Additional uses:** Tuberculosis (T.B.), plague, cholera, bacterial endocarditis caused by hemophilus influenza.

**Add. Contraindications:** contact dermatitis, myasthenia gravis.

**Dosage:** for T.B. initially 1 g daily with other antitubercular drugs then 1 g 2-3 times /week for minimum of 1 year.
5) **Tobramycin Sulfate:-**

**Trade name:** Nebcin.

**Class. :-** Antibiotic, aminoglycosides.

**Add. Uses :-** meningitis, neonatal sepsis.

**Formulation:-** 2ml vials containing 20 mg.

**Dosage :-** IM + I.V. adults 3 mg/kg/day q8 hr.
- Pediatric 2-2.5 mg/kg q8 hr.
- Neonates 4 mg/kg/day q12 hr.

---

**Cephalosporins**

- Are semisynthetic antibiotics that resemble the penicillins both chemically and pharmacologically.
- Are absorbed rapidly from the GI tract and quickly reach effective concentrations in the urinary, GI and respiratory tracts except in patients with pernicious anemia or obstructive jaundice & eliminated rapidly in patients with normal renal function.
- They are broad- spectrum antibiotics that have been classified as first, second and third generation drugs. The difference among generations is based on antibacterial spectra.
- Third generation cephalosporins have more activity against gram negative organisms and resistant organisms & less activity against gram positive organisms than first generation drugs. They are also stable against beta-lactamases enzymes.
- The cost increases from 1st to 3rd generation cephalosporins.
- **Action:**- They interfere with the final step in the formation of the bacterial cell wall resulting in unstable cell membranes that undergo lysis, also cell division & growth are inhibited.
- **N.B. :-** 1st & 2nd generation drugs don’t enter the CSF well, but 3rd generation drugs enter inflamed meninges readily.
- Cephabsporins are excreted rapidly by the kidneys.
- **Uses:-** They are effective against infections of :-
  1- Biliary tract
  2- BI tract
  3- GU tract
  4- Bones & joints
  5- Upper & lower respiratory tract
  6- Skin
  7- Meningitis
  8- Osteomyelitis
  9- Peritonitis
  10- Otitis media
  11- Gonorrhea
  12- Prophylaxis prior to surgery.

**Contraindications :-** Hypersensitivity to cephalosporins or Penicillin, renal failure, Pregnancy, Lactation.

**Side effects :-**

Nausea, vomiting, diarrhea, anorexia, abdominal pain, flatulence, skin rashes super-infection, heartburn, sore mouth, bone marrow depression: (Decrease WBC, decreased platelets, decreased Hct), Nephrotoxicity,
(pain, abscess at injection site, phlebitis and inflammation at IV site), superinfection.

**Nursing considerations:**
- Infuse over 30 minutes unless otherwise indicated.
- Therapy should be continued for at least 2-3 days after symptoms of infection have disappeared.
- Assess client with a history of hypersensitivity reaction. “for penicillin or cephalosporins.”
- Assess client financial status. These drugs are usually expensive.
- If GI upset occurs administer drugs with meals. “should be administered on empty stomach”.
- Obtain liver & renal studies.

**Examples :-**

1) **Cefaxor :-**
   - **Trade name:** ceflor
   - **Classification:** antibiotic, cephalosporin “second generation”
   - **Uses:** otitis media, infections of upper & lower respiratory tract. UTI & skin infections.
   - **Dosage:** Capsules, oral suspension. 250 mg q 8 hr & may be doubled in case of severe infection. (for adults). Children 20 mg/kg/day in 3 divided doses.
   - **Specific nursing consideration:**
     - The suspension should be refrigerated after reconstitution and discarded after 2 weeks.

2) **Cefixime, oral :-**
   - **Trade name:** suprax.
   - **Classification:** antibiotic, cephalosporin (third generation).
   - **N.B.:** The only third generation drug can be given orally.
     - Stable in the presence of beta-lactamase enzymes.
   - **Uses:** Uncomplicated UTI, pharyngitis, tonsillitis & acute bronchitis.
   - **Additional side effects:** Flatulence, alkaline phosphatase levels.
   - **Dosage:** oral suspension, tablets. Adults either 400 mg once daily or 200 mg q12 hr. – children 8 mg/kg / day.
   - **Specific nursing consideration :-**
     - Once reconstituted, the suspension should be kept at a room temp.
     - where it maintains potency for 14 days.
     - Therapy should be taken once a day at the same time each day.

3) **Cefotaxime Sodium:-**
   - **Trade name:** claforan.
   - **Class.** Antibiotic, cephalosporin (third generation).
N.B.: Treatment should be continued for a minimum of 10 days for group A beta-hemolytic streptococcal infections to minimize the risk of glomerulonephritis or rheumatic fever.

The I.V. route is preferable for patients with severe or life-threatening infections.


N.B. used with aminoglycosides when causative agent has not been identified.

Dosage: I.V., I.M. 1 gm q 12 hr (adult).
Moderate to severe inf. 1-2 g q 6-8 hr.
Pre-op. Prophylaxis, 1 g 30-90 min prior to surgery.

Nursing considerations:-
- Should not be mixed with aminoglycosides. (each should be given separately)
- For I.V. use, should be mixed with 10 ml sterile water & administer over 3-5 minutes.

4) Ceftriaxone Sodium:-

Trade name: Rocephin.

Class: Cephalosporin (third generation), antibiotic.

Uses: pneumonia, UTI, infections of skin, bone & abdomen.
Meningitis, bacterial septicemia, pre-op. prophylaxis.

Dosage: I.V., I.M. adult 1-2g daily in single or divided doses q 12 hr.
- Pediatric: 50-75 mg/kg/day (other than meningitis) meningitis 100 mg/kg 1 day.

Nsg considerations:-
- I.M. injection should be deep into the body of large muscle.
- I.V. injection should be diluted.
- For stability of solution the package insert should be checked carefully.
- Dosage should be maintained for at least 2 days after symptoms of infection have disappeared (usual course is 4-14 days).

5) Cefuroxime Sodium:-

Trade names: Zinacef, Zinnat.

Class: Antibiotic, cephalosporin (second generation).

Uses: P.O. (pharyngitis, tonsillitis, UTI, bronchitis), I.M. or I.V. (pneumonia, UTI, osteomyelitis, meningitis, septicemia, pre-op. Prophylaxis).

Add. Side effects in Hb & HCT (hematocrit).

Dosage: tablets 250-500 mg q 12 hr. (adult)
125 mg bid (children).
I.M. –I.V. 750 mg q 8 hr
Severe infection 1.5 g q 6-8 hr.

6) Cephalexin monohydrate:-

Trade names: Keflex, Jeflex.
7) **Cephalothin sodium:**

- **Class:** Antibiotic, cephalosporin (first generation).
- **Trade name:** Keflin.
- **Uses:** Infections of respiratory tract, skin, bones & GU.
- **Add. Side-effects:** Nephrotoxicity, cholestatic jaundice.
- **Dosage:** Caps., suspension, tab. 250-500 mg q 6 hr.

**Chloramphenicol:**

- **Trade names:** Chloromycetin, Synthomycetin, Synthomycin
- **Class:** Antibiotic, cephalosporin (first generation).
- **N.B.:** Poorly absorbed from GI tract & must be given parenterally.
- **Dosage:** Deep I.M. or I.V. 500-1000 mg a 4-6 hr.
- **Uses:** See Keflex.

**Chloramphenicol:**

- **Trade names:** Chloromycetin, Synthomycetin, Synthomycin
- **Class:** Antibiotic, cephalosporin (first generation).
- **N.B.:** Poorly absorbed from GI tract & must be given parenterally.
- **Dosage:** Deep I.M. or I.V. 500-1000 mg a 4-6 hr.
- **Uses:** See Keflex.
- Oral anticoagulants: effect of anticoagulant (it’s breakdown by liver)

**Formulation:-** tablets 250 mg, vial 1g.

**Dosage:-** 50 mg/kg daily in 4 divided doses q 6hr.

**Nursing considerations:-**
- Administer I.V. as 10% solution over at least 1 min.
- Note any history of hypersensitivity & other contraindications, & if client takes antidiabetic or other medications that cause bone marrow depression.
- Neonates should be observed closely (greater hazards of toxicity).
- Arrange for further hematologic studies to be conducted every 2 days to detect early signs of bone marrow depression.
- The drug should be taken at regular intervals to be most effective.
- The drug should be taken 1 hr before or 2 hr after meals (if GI upset occurs it can taken e food).

**Clindamycin phosphate:-**
- **Trade name:** Dalacin.
- **Class:** antibiotic, clindamycin.
- **N.B.** It is a semisynthetic, particularly effective against a variety of gram +ve organisms as staphylococci, streptococci & pneumococci & some gram –ve organisms.
- Should not be used for trivial infections.
- **Action:-** suppress protein synthesis by microorganisms by binding to ribosomes. It is both bacteriostatic & bactericidal.
- **Uses:-**
  1. Serious respiratory tract infections. (lung abscess, pneumonia).
  2. Serious skin infections.
  4. Osteomyelitis caused by staphylococci.
  5. Used topically for inflammatory acne vulgaris.

**Contraindications:-**
- Hypersensitivity
- Minor bacterial infections.
- Pregnancy.

**Side effects:-** Nausea, vomiting, diarrhea, abdominal pain, tenesmus. Loss of weight, pseudomembranous colitis, skin rashes. Hypotension. Thrombophlebitis following I.V. use.

**N.B.:-** The injection contains benzyl alcohol which has been associated with a fatal gasping syndrome in infants.

**Dosage:-**
- P.O. caps. or solution, 150-450 mg q 6hr.
- I.V. 0.6-2.7 g daily in 2-4 equal doses.
- Topical gel/solution thin film bid.

**Nursing considerations :-**
- Give parenteral drug to hospitalized client only.
- Dilute I.V. injections. If I.M., inject medication deeply.
- Don’t refrigerate solution (because it becomes thick).
- Before use, take full history & not signs of allergy.
- Be prepared to manage colitis which can occur 2-9 days or several weeks after initiation of therapy. Which includes.
  Fluids, Electrolytes, Protein supplement, Corticosteroids, and Vancomycin (as ordered).
- During I.V. administration, observe for signs of hypotension.
- Administer only on an empty stomach. (with a full glass of water to prevent esophageal ulceration).

Erythromycin:--

**Action:**
- Inhibits protein synthesis of microorganisms by binding to ribosome.
- It is effective only against rapidly multiplying organisms.
- Absorbed readily from the upper GIT (small intestine).
- Are manufactured in enteric-coated or film-coated forms to prevent destruction by gastric acid, diffuse poorly to C.S.F. & primarily excreted in bile.

**Uses:**
1. The drug of choice to treat respiratory tract infections.
2. Intestinal amebiasis.
3. An alternate drug to treat the following conditions in patients who are allergic to penicillin.
   - Infections due to group A- beta hemolytic streptococci.
   - To prevent bacterial endocarditis prior to dental procedures.
   - Venereal disease (gonorrhea or syphilis).
4. Conjunctivitis of the newborn.
5. Long term prophylaxes in rheumatic fever.

**Contraindication:**
- Hypersensitivity.

**Side effects:**
- Nausea, vomiting, diarrhea, skin rashes.
- Hepatotoxicity, confusion.
- I.V. uses: thrombophlebitis
- Hearing loss: in patients receiving high doses or with renal function impairment.

**Formulation:**
- Tablets 250 mg, suspension: 125 mg, 200 mg, 400 mg.

**Dosage:**
- The usual adult dose is 250 mg q 6 hr (can be doubled in severe infections).
- Children, 30-50 mg/kg in divided doses.

**Nursing Consideration:*
1. Should be taken on an empty stomach.
2. In the treatment of staphylococcal infections, should be administered for at least 10 days.
3. Don’t administer with fruit juice or other acidic drinks because it may decrease the activity of the drug.
1- Asteronam for injection:
- **Trade name:** Azactam
- **Class:** monobactam antibiotic.
- **Action:**
  - It belongs to a new class of antibiotics called monobactam.
  - It is bactericidal against gram negative aerobic pathogens. It inhibits cell wall synthesis.
- **Uses:**
  - Infections due to gram negative organisms like: UTI, lower respiratory tract infections, septicemia.
  - Skin & intra-abdominal infections.
- **Contraindications:** Allergy.
- **Side effects:**
  - Nausea, vomiting, abdominal cramps.
  - Seizures, vertigo, pancytopnea.
  - Skin rashes, hypotension.
- **Dosage:**
  - I.M., I.V. (1g vials)
  - 0.5-1g 9 8-12 hr (can be doubled in severe infections).
- **Nursing considerations:**
  - Therapy should be continued for 2 days after disappearance of symptoms of infection.
  - Inject I.V. therapy slowly over 3-5 min.
  - Obtain baseline liver & kidney function studies.
  - If administered I.M., use large muscle, and do not give more than 1 g.

2. Vancomycin Hydrochloride:
- **Trade name:** vancomycin.
- **Class:** Antibiotic, miscellaneous.
- **Action:** It is derived from streptomycetes orientalis, it appears to bind to bacterial cell wall, arresting it’s synthesis and lysing the cytoplasmic membrane by a mechanism that is different from that of penicillin. It is bactericidal for most organisms and bacteriostatic for enterococci.
- **N.B.** It is poorly absorbed from GIT so it should be administered parenterally only for life threatening infections.
- **Use:** drug should be reserved for treatment of life threatening infections when other treatment have been ineffective.
- **Uses:**
  1. Patients with severe staphylococcal infections resistant or allergic to penicillins or cephalosporins such as:
    - * Endocarditis
    - * Pneumonia
    - * Osteomyelitis
    - * Septicemia
  2. Oral administration is useful in treatment of:
    - * enterocolitis
    - * pseudomembranous colitis
- **Contraindications:**
  - * Hypersensitivity
  - * Minor infectious.
- **Side effects:**
  - Ototoxicity → deafness
  - Nephrotoxicity → uremia
- Red-Neck syndrome: “chills, erythema of neck and back fever”.
- Skin rashes, Drug fever
- Hypotension (due to rapid administration).
- Thrombophlebitis at site of injection.

**Drug interactions:**
Never give with other ototoxic or nephrotoxic agents especially aminoglycosides.

**Dosage:** Caps., syrup, or I.V. 0.5 g q 6hr or 1g q 12 hr.

**Nursing considerations:**
- Mix as indicated on package insert.
- Intermittent infusion is the preferred route.
- Avoid rapid I.V. administration → nausea & hypotension.
- Avoid extravasation during injections.
- Monitor vital signs, intake of output.

3. **Ciprofloxacin Hydrochloride:**

**Trade name:** cipro (ciproxin)

**Class:** Antibacterial, quinolone derivative.

**Action:** is a synthetic quinolone with broad-spectrum bactericidal activity, inhibits the synthesis of bacterial DNA by inhibiting the enzyme DNA gyrase.

**Uses:** UIT, infectious diarrhea
Infection of lower respiratory tract, bone, joints & skin.

**Contraindications:**
Hypersensitivity - children - lactation.

**Side-effects:** Nausea vomiting, dysphagia, crystalluria, hematuria.
Rashes, bad taste, GI bleeding, Headache, insomnia.

**Dosage:** 250-500 mg q 12hr for 7-14 days.

**Nursing considerations:**
- Give medication 2 hr after meals.
- Stress importance of drinking increased amounts of fluids to keep urine acidic & to minimize the risk of crystalluria.

*Penicillins*

**Class:** Anti-infective.

**Action:** Inhibit cell wall synthesis, some act by binding to penicillin binding protein in the cytoplasmic membrane of the bacteria, some act by acylation of protein-bound transpeptidase enzymes thereby preventing cross-linkage of peptidoglycan chains that are necessary for bacterial cell wall strength and rigidity. So it inhibit cell division & growth.
- It is bactericidal & bacteriostatic “according to concentration of drug and microorganism”.
- It is most effective against young, rapidly dividing organisms, therefore, they are not used for bacteria in resting phase.
- They diffuse well into body tissues and fluids
- They are excreted in the urine in the therapeutic concentration.
- They do not kill bacteria in the resting phase.

**Uses:-**
1- Gram +ve cocci “streptococci, meningococci, pneumococci ….”. 
2- Subacute bacterial endocarditis caused by group A streptococci.
3- Gonorrhea due to gonococci.
4- Diphtheria, tetanus, anthrax, gas gangrene.
5- Prophylaxis for rheumatic fever.

**Note:** Not all penicillins are used for the above diseases. Specific uses are indicated for each of the individually listed drugs.

**Contraindications:**
Hypersensitivity to penicillins & cephalosporins.

**Side effects:** Allergic skin rashes, pruritus, wheezing, fever…. Diarrhea, abdominal cramps, pain, nausea, vomiting.
Psedomembranous colitis, thrombocytopenia, leukopenia.
Thrombophlebitis + Electrolytes imbalance following I.V. use.
Hepatotoxicity.
I.M. injection may cause pain at the injection site.

**N.B.** :- Emergency treatment of allergy includes:
1- epinephrine
2- corticosteroids
3- oxygen
4- antihistamines

**Dosage:** Individualized.

**General Nsg considerations for penicillins:**
1- These antibiotics should be injected slowly to minimize local irritation.
2- I.M. injections are made deeply into the gluteal muscle.
3- Assess regularly for allergic reactions. If reaction occurs the drug must be discontinued immediately, Epinephrine ‘O2’ antihistamines + corticosteroids must be immediately available.
4- Detain client in an ambulatory care site for at least 20 min after administering Penicillin.
5- Don’t administer long-acting types I.V., they are only for I.M. use & don’t massage after injection because rate of absorption should not be increased.
6- Take oral penicillin 1 hr before or 2-3 hr after meals.
7- Complete entire prescribed course of therapy.

1) **Ampicillin:**

**Trade name:** Penbritin.

**Class:** Antibiotic, penicillin.

**Notes:** Destroyed by penicillinase (lactamase enzymes)
- 30-60% absorbed from GIT after oral use.
- Acid resistant.
- Broad – spectrum antibiotic.

**Uses:** Is particularly recommended in respiratory, urinary & GI tract infections & other infection due to ampicillin sensitive organisms.

**Dosage forms:**
Capsules 250 mg, suspension 125 mg/5ml, vials 250, 500, 1000 mg.
Ampecillin forte capsules 500 mg, ampecillin forte suspension 250 mg/5ml.

**Dosage:**
- P.O./I.V. or I.M. 250 mg – 500 mg q 6 hr (adult)
- Children 50 my/kg 1 day in 4 divided doses.
- N.B. For bacterial meningitis
- Adults: 12g is given in divided doses q 6 hr.
- Children: up to 400 mg\kg daily in divided doses q 4 hr.

**Specific nursing considerations:**
- After reconstitution for I.M., I.V. administration, the solution must be used within the hour.
- I.V. administration, should be given slowly within 3-5 minutes or by infusion.

2) **Amoxycillin** :
- **Trade name**: moxypen.
- **Class**: Antibiotic, penicillin.
- **Notes**: Inactivated by penicillinase, including those produced by staphylococcus aureus and gram negative baccili.
  - Acid stable
  - Is a broad spectrum antibiotic.
  - Absorbed well from the GIT.

**Uses**: UTI - Respiratory infections - gonorrhea
  - skin infections.

**Dosage Forms**:
Caps. – 250 mg, suspension 125 mg \5 ml
Moyxpen forte caps. 500 mg, Moxypen forte suspension. 250 mg\5ml
**Dosage**: 250-500 mg q 8 hr.

**Specific nursing consideration**: Reconstituted suspension is stable for 1 week at room temp. & for 2 weeks at 2-8 Centigrade degrees.

3) **Amoxycillin & Potassium Clavulanate**:
- **Trade name**: Augmentin.
- **Class**: Antibiotic, penicillin.
- **Notes**: Potassium clavulanate inactivates beta-lactamase enzymes which are responsible for resistance to penicillins.
- **Dose**: tablets or suspension 250 mg q 8 hr.

4) **Cloxacillin**:
- **Trade name**: Orbenin
- **Class**: Antibiotic, penicillin.
- **N.B.**: More resistant to penicillinase than is penicillin G.
- **Uses**: Infections caused by penicillinase-producing staphylococci, streptococci, pneumococci.
  - Osteomyelitis
  - pneumonia
  - infected wounds & burns
  - Septic arthritis.

**Dosage forms**: vials containing 250 mg, 1g.
Capsules 250 mg - 500 mg.
Syrup 125 mg \5 ml, 250 mg\5ml.
**Dose**:
- Adult: 250 – 500 mg q 6 hr.
- Children: 50 mg\kg per day in 4 divided doses.

**Nursing considerations**:
- Administer on an empty stomach.
- Refrigerate reconstituted solution & discard remaining amount after 14 days.
N.B. : To prepare oral suspension, add amount of water stated on label and shake well.
- shake the bottle well before each use.

5) Methicillin Sodium:
- **Trade name:** staphcillin.
- **Class.:** Antibiotic, penicillin.

**N.B.** it is a penicillinase- resistant salt suitable for:
1. Soft tissue infections
2. penicillin G resistant infections.
3. Resistant Staphylococcal infections.

- **Uses:** Infections caused by penicillinase- producing staphylococci.
- Osteomyelitis, septicemia.

- **Dosage:** I.M, continuous I.V. infusions.
- 4-12 g daily in 4-6 divided doses depending on the infection.

6) Penicillin G, Benzathine and procaine combined:
- **Trade name:** Bicillin C-R., Duplo-penicillin, procaine benzyl penicillin.
- **Class.:** Antibiotic, penicillin.

**Uses:** Streptococcal infections (without bacteremia) of:
1. Upper respiratory tract such as Tonsillitis, pharyngitis.
2. Otitis media
3. Skin and soft tissue infections.
4. Scarlet fever.
5. Acute glomerulonephrites.
7. Rheumatic fever.

- **Formulations:**
  Vials containing 1.2 MU, 2 MU.

**N.B.** Penicillin G is inherently rapid in action while procaine penicillin G provides penicillin G in a prolonged action from.

- **Contraindications:** Hypersensitivity to penicillin.
- **Side effects:** nausea, vomiting, stomatitis, skin rashes, anaphylaxis.

- **Dosage:** I.M. ONLY
  - Adult: 1,200,000 – 2,400,000 units “10 days for streptococcal inflections”
  - Pediatric: 600,000 – 1,200,000 units.

**Nursing considerations:**
- Shake multiple-dose vial vigorously before withdrawing the desired dose.
- Use a 20- gauge needle & don’t allow medication to remain in the syringe & needle for long periods of time before administration because the needle may become plugged & the syringe “frozen”.
- Inject slowly into the muscle & don’t massage the injection site.
- Before injection of medication, aspirate needle to ascertain that needle is not in a vein.
- Rotate site of injections.
- **Don’t administer I.V..**
  - If dose is large and the available muscle is small, divide the dose into 2 injection sites.

7) Penicillin G Benzathin, ORAL (Phenoxyethyl penicillin)
Trade name: Bicillin.  
Penicillin G Benzathin, Parenteral. ( Benzyl penicillin)  
Trade name : Durabiotic , Bicillin L-A ( long acting penicillin).  
Class: Antibiotic, penicillin.
N.B. The parenteral product is long – acting form of penicillin in an aqueous vehicle. It is administered as a sterile suspension.
Uses: Most gram +ve (streptococci, staphylococci, pneumoeocci) & some gram -ve (gonococci) organisms.
Syphilis
Prophylaxis of glomerulonephritis & rheumatic fever.
Surgical infections.
Secondary infections following tooth extraction + tonsillectomy.
Contraindications: Hypersensitivity to penicillin.
Dosage form: vial containing 1,2 mu.
Dosage: tablet :- 200,000 – 600,000 units q 4-6 hr.
Parenteral suspension: 1,200,000 units as single dose for adults and for pediatric 300,000 – 900,000 units as a single dose.
Early syphilis: 2,400,000 units q 7 days for 3 weeks.
Prophylaxis of Rheumatic fever: 1,200,000 units as a single dose every 4 weeks.
Children: half the adult dose.
Side effects + Nursing considerations:
See the previous drug.

8) Penicillin G Sodium “ for injection” : [Benzylpeniollin Na].  
Trade name: Crystapen, crystaline penicillin.
Penicillin G potassium “ oral” + Injection [Benzylpenicillin k]  
Trade name: Megacillin.
Class: Antibiotic, penicillin.
N.B. : * The low cost of penicillin G still makes it the first choice for treatment of many infections.
Rapid onset makes it especially suitable for fulminating infections.
Destroyed by acid & penicillinase.
Add side effects:
Rapid I.V. administration may cause hyperkalemia & cardiac arrhythmias.
Uses: Infections due to penicillin- sensitive organisms.
N.B. : Penicillin G potassium is indicated as on alternative to penicillin G sodium in those patients in whom intake of sodium must be restricted.
Contraindications: Hypersensitivity .
Dosage forms: Penicillin G potassium (injection) vial of 1 MU.
Penicillin G sodium vials 1,5,10 Mu.
Dosage: I.M. , continuous I.V. infusion 300,000 – 30 million unit depending on the use.
- Pediatric: 100,000 – 250,000 units \( \text{kg daily in divided dose} \).
- Oral sol\tabs, Adult: 200,000 – 500,000 units q 6-8 hr.
- Pediatric: 25,000 – 90,000 units \( \text{kg daily in divided doses} \).
- (Note = 250 mg of oral sol. = 400,000 units of injection solution).
Nursing considerations:
- I.M. is preferred, minimize discomfort by using solution of up to 100,000 units/ml.
- Monitor intake & output (I & O).
- Solution may be stored at room temp. for 24 hr or in refrigerator for 1 week.
- Use 1% - 2% lidocaine as a diluent for I.M. use to decrease pain at injection site.
- Note the penicillin G should not be mixed during I.V. administration with the following drugs: aminophylline, gentamycin, heparin, vancomycin & sodium bicarbonate.

9) Penicillin V Potassium:

- **Trade name:** Rafapen.
- **Class:** Antibiotic, penicillin.
- **N.B.:** Is related to penicillin G.
- Is acid stable and resist inactivation by gastric secretions.
- Well absorbed from the GIT & not affected by food.
- **Dosage forms:** Tab. 250 mg (400,000 units), 500 mg (800,000 units).
  - Syrup 125 mg/5ml (200,000 units), 250 mg (400,000 units).
- **Dosage:** according to causative agent 125 mg – 500mg 9 6-8 hr for 10 days.

10) Piperacillin sodium:

- **Trade name:** Pipraul, class: Antibiotic, penicillin.
- **N.B.** Broad-spectrum penicillin for parenteral use. It penetrates CSF in the presence of inflamed meninges.
- **Additional uses:** Intor-abdominal infections, septicemia, bone infections.
  - prophylaxis in surgery of GI and biliary tracts and in cases of hystrectomy and cesarean section.
- **Dosage:** serious infections I.V. 3-4g 9 4-6 hr.

**Tetracyclines**

- The tetracyclines inhibit protein synthesis of microorganisms by binding to its ribosomes, thereby interfering with protein synthesis. Cell wall synthesis isn’t inhibited.
- The drugs are mostly bacteriostatic and are effective only against multiplying bacteria.
- Well absorbed from the stomach & upper GIT. And can pass through the placental barrier.
- **N.B.** They are deposited in the fetal skeleton and calcifying teeth.

**Uses:**

- **N.B.** Due to development of resistance, they are usually not used for infections by common gram +ve & gram –ve organisms.
  - They are the drugs of choice for rickettsial infections as:
    1- Rocky mountain spotted fever.
    2-Endemic typhus.
    - Urethritis due to mycoplasma.
    - Prophylaxis of plague after exposure.
Adjunct treatment of trachoma, & acute intestinal amebiasis. They are the drug of choice for gram –ve bacteria causing:

1- Cholera
2- Brucellosis.

Alternative treatment to penicillin for uncomplicated gonorrhea.

Vaginitis, severe acne.

Topical uses include skin granuloma.

Contraindications:
- Hypersensitivity.
- During tooth development stage:
  1- Last trimester of pregnancy.
  2- Neonatal period.
  3- During breast feeding.
  4- During childhood up to 8 years.

N.B.: Because they interfere with enamel formation and dental pigmentation.
- Never adm. intrathecally.

Side effects: most common: Nausea, vomiting, thirst, diarrhea flatulence, sore throat & anorexia.
  - Black hairy tongue   - esophageal ulcer .
  - Skin rashes.   - photosensitivity.
  - Discoloration of nails & infants & children’s teeth.
  - Delayed bone growth.
  - I.V. use may cause thrombophlebitis.

N.B.: The adm. of deteriorated tetracylines may result in “ Fanconi- like syndrome” characterized by nausea, vomiting, acidosis, proteinuria, hypokalemia, polyuria & polydipsia.

Dosage: Individualized.

Nursing considerations:
- Don’t use outdated or deteriorated drugs. , Discard unused medications.
- Adm. I.M. deeply in large muscle mass.
- Adm. on an empty stomach (1hr before or 2 hr after meals).
- If the client is female & pregnant, determine what trimester she is in.
- Report side effects to physician.
- Avoid direct sunlight, which can cause a sever sunburn-like reaction.

Examples:
1- Tetracycline Hcl
For candidal infections.

2- Chlortetracycline Hcl (ophthalmic & topical 3% on affected area 1-5 times daily).

3- Doxycycline:
Trade names: Doxylin , Doxypal , Doxypharm, vibramycin, doxacylin.
Class: Antibiotic, tetracycline.

Dosage form: Caps., film-coated tab. 100 mg
Dose: The usual dose for adults.
  First-day 100mg  q 12hr   followed by 1 tab. a day.
  In sever cases: 2 tablets daily in divided doses.

Side effects: nausea, vomiting, diarrhea, headache, hypertension, colitis, hemolytic anemia.

Nursing consideration:
do not give with antacid, milk, or any product that contains calcium, zinc, aluminum, magnesium, and ferric salts, because these products decrease the absorption of the drug.

4- Oxytetracycline:
Trade name: Terramycin
Class: antibiotic, tetracycline.
Dose: tab., see the previous drug.
I.M. 250 mg once daily.

**Antifungal Agents**

Several types of fungi or yeasts are pathogenic for humans.

Fungal infections may be systemic, limited to skin, hair or nails or infect moist mucous membranes including the GI tract and vagina.

Candida organisms belong to this group.

Drug therapy depends both on the infectious agent & on the type of infection.

An accurate diagnosis of the infection before therapy is most important for the choice of the therapeutic agents.

It is important that drug therapy be continued until the infectious agent has been completely eradicated to avoid the emergence of resistant strains.

1- Amphotericin B:
Trade name: Fungizone.
Class: Antibiotic, antifungal.
Action: It is produced by streptomycetes nodosum & the drug of choice for deep infections. It binds to specific chemical structures “sterols” of the fungal cellular membrane, increasing cellular permeability and promoting loss of potassium and other substances.

| Fungistatic or fungicidal “ depending on the dose”.
| Is poorly absorbed from the GIT , It can be adm. I.V. ,
| intrathecally or topically.

Uses:
N.B.: The drug is toxic and should be used only for patients under close medical supervision with a relatively certain diagnosis of deep mycotic infections.
I.V. adm. usually reserved for life threatening diseases because it is toxic.

Systemic fungal infections, e.g. histoplasmosis, disseminated candidiasis & monilial over growth resulting from oral antibiotic therapy.

Topical coetaneous & mucocutaneous infections of candida “monilia” infections.

Contraindications: Hypersensitivity.

Side effects:
Topical use: pruritis, dry skin, and irritation.
IV use: nausea, vomiting, diarrhea, melena, abd. cramps.
Fever, headache, thrombophlebitis, bone marrow depression, pancytopenia, anaphylaxis.
2-  **Nystatin:**

**Trade name:** mycostatin.

**Class:** antibiotic, antifungal.

**Action:** It is natural antifungal antibiotic derived from streptomycyes noursei & both fungistatic & fungicidal against all species of candida. It binds to fungal cell membranes “sterols”, resulting in altered cellular membrane permeability & leakage of potassium & other essential components & excreted in feces.

**Uses:** candida infections of the skin, mucous membranes, GI tract, vagina & mouth (thrush).

**N.B.:** The drug is too toxic for systemic infections, although it can be given P.O. for intestinal moniliasis infections as it is not absorbed from the GI tract.

**Side effects:** Has few toxic effects nausea, vomiting, diarrhea.

**Dosage forms:**
- Suspension: contains 100,000 units/ml “12 ml bottle with dropper”.
- Ointment: contains 100,000 units/g “15 g tube”.
- Vaginal tab.: Contains 100,000 units.

**Dosage:**
- Suspension. For adult: 2 ml, 4 times daily.
- Pediatric: 1 ml, 4 times daily.
- Vaginal cream or tab. 1 tab. inserted into vagina once or twice each day for 2 weeks.

**Nursing considerations:**
- Don’t miss oral suspension in foods since the medication will be inactivated.
- Apply cream/ointment with a swab.
- Instruct client to keep medication in mouth as possible before swallowing.
- Insert vaginal tab. high in vagina with an applicator.
- Treatment should be continued for at least 48 hr after clinical cure has been achieved to prevent relapse.

3. **Tolnaftate:**

**Trade name:** pitrex.

**Class:** Topical antifungal.

**Action:** The exact mechanism is not known although the drug is thought to stunt mycelial growth causing antifugal effect.

**Uses:** Tinea pedis, tinea cruris, tinea corporis & tinea versicolor. Fungal infections of moist skin areas.

**Contraindications:** Scalp & nail infections “avoid getting into eyes”

**Side effects:** mild skin irritation.

**Dosage form:** cream tubes of 10 g.
- Solution Bottles of 10 ml.

**Dosage:** Apply bid. for 2-3 weeks.

4. **Natamycin:**

**Trade name:** Natacyn.

**Class:** antifungal (ophthalmic).
**Action:** see Nystatin.

**Uses:** for ophthalmic use only. e.g. fungal blepharitis & conjunctivitis.

**Contraindications:** Hypersensitivity.

**Side effects:** eye irritation.

**Dosage:** 1 g tt of 5% susp. q 1-2 hr, reduced after 3-4 days to 1 gtt q 6-8 hr.

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**5. Miconazole:**

**Trade name:** Daktarin.

**Class:** antifungal agent.

**Actions:** as Nystatin. It also inhibits biosynthesis of triglycerides & phospholipids & also inhibits oxidative enzyme activity.

**Uses:** Systemic fungal infection e.g. mucocutaneous candidiasis.

- Skin, nail & hair infections.
- Tinea pedis (athlete’s foot), tinea corporis.
- Oral thrush (oral gel).
- Against some gram +ve bacteria.

**Contraindication:** Hypersensitivity.

**Side effects:**
- Topical: skin rashes, headache, burning, irritation.
- Systemic: nausea, vomiting, diarrhea, anorexia fever, thrombocytopenia.

**Dosage forms:**
- Cream: tubes of 15g or 30g.
- Lotion: bottles of 20 ml.
- Oral gel: tubes of 40g.

**Dosage:** I.V. 300–3600 mg / day in divided doses.

- Topical apply to cover affected areas in morning & evening.
- Vaginal cream/supp. One supp. Daily at bedtime for 7 days.

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**6. Ketoconazole:**

**Trade name:** Nizoral.

**Class:** Broad-spectrum antifungal.

**Action:** see miconazole.

**Uses:** candidiasis, oral thrush.

**Contraindications:** Hypersensitivity.

- Lactation.
- Ophthalmic use.

**Side effects:** nausea, vomiting, diarrhea, fever, headache, photophobia, hepatotoxicity. Gynecomastia, impotence, thrombocytopenia.

**Dosage:**
- Tab, oral susp.
  - 200–400 mg. As a single dose/day.

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**Sulfonamides**

Bacteria needs para-aminobenzoic acid dihydrofoleric acid to multiply.

**Action:** sulfonamides are structurally related to para-aminobenzoic acid, the bacteria take it instead of these acids. So, tetrahydrofoleric acid is not formed which is necessary for synthesis of DNA, no cell multiplication.

Bacteriostatic, not bactericidal.

Relatively inexpensive drugs.
Excreted mainly via kidneys.

**Uses:**
- Less useful because of bacterial resistance & development of other antibiotics.
- UTI e.g. E. coli, proteus & staph. Aureus. “cephalosporines are given now”.
- To eliminate meningococci from nasopharynx (carriers).
- As alternative to penicillin for prophylaxis from rheumatic fever.
- As alternative to tetracycline in treatment of chlamydia, trachoma & conjunctivitis.
- In combination with penicillin to treat otitis media.

**Contraindications:**
- Pregnancy except for treatment of toxoplasmosis.
- Used with caution in patients with impaired liver & kidney function & blood disorders.

**Side effects**
- Nausea, vomiting, stomatitis, abdominal pain, headache, dizziness, ataxia, photosensitivity, rash.
- Steven–Johnson syndrome (rhinitis, conjunctivitis, fever, stomatitis, & rash).
- Renal damage — crystaluria, hematuria, proteinuria.
- Hemolytic anemia, aplastic anemia. Jaundice.
- Superinfection.

**Note**
Vitamin K should be administered to patient take long-term sulfonamide since, it kills normal flora.

**Nursing consideration:**
- Obtain a thorough nursing and drug history.
- If the client is pregnant, the physician should be informed so that, another type of medication not harmful to a developing fetus may be used.
- During drug therapy, assess client for any of the following: reactions that may require withdrawal of the drugs:
  - Skin rashes, abdominal pain & anorexia.
  - Jaundice (hepatic involvement).
  - Renal colic, oliguria, anuria, proteinuria (renal involvement).
  - Jaundice, pallor, weakness (blood dyscrasias).
  - Rhinitis, stomatitis, fever, headache, conjunctivitis (Steven-Johnson syndrome).
  - Hemorrhage, due to vitamin K deficiency.
- Monitor intake and output.

1- **Silver sulfadiazine: Silvadene, Silverol cream.**

**Uses:**
- Topically for prevention and treatment of sepsis in second and third degree burns.
- Minor bacterial skin infections and dermal ulcers.
Dosage: Once or twice daily topically by sterile gloves over a clean or debried burn.

Contraindications:
Pregnancy, lactation, infant below 2 months.

2- Mafenide Acetate: Sulfamylon
Class: Topical sulfonamide.
Uses: for prevention of infection in 2nd and 3rd degree burns.
Contraindications: Not to be used for already established infection used with caution in pregnancy & lactation.
Dosage: As silver sulfadiazine.

3- Sulfacetamide sodium: Optizole eye drops, Ramasulf.
Class: sulfonamide.
Uses: Topically for treatment of ophthalmic infections including trachoma.

4- Sulfamethoxazole and trimethoprim:
Trade name: Resprim, septrin, pathoprim, Bactil, septin, ultrasept
Dosage forms:
- Oral susp.: Sulfamethoxazole 200 mg + trimethoprin 40 mg \( \times \)ml.
- Tablets: Sulfamethoxazole 400 mg & trimethoprin 80/tab.
- Double strength tab. (forte): Sulfamethoxazole 800 mg + trimethoprin 160 mg\tab.
Uses: UTI, otitis media, enterites (shigella), bronchitis (adult)
Add. Contraindications: Megaloblastic anemia due to folate deficiency.
Infants less than one month of age.
Dosage: one or 2 tablets q 12 hours/adults, or 4 teaspoonful 9 12 hrs for 10-14 days.

5- Sulfasalazine: Salazopyrin
Uses: ulcerative colitis
Drug interactions: Digoxin → effect of salazopyrin
Ferrus sulfate → Blood level of salazopyrin.

Anthemintics
- Helminths (worms) may infect the intestinal mucosa or lumen and can migrate to a particular tissue.
- Treatment of worms infection is complicated since a worm may have one or more morphological stages.
- All family members should be examined since infestations are transmitted by sharing bathrooms (hygiene is very important).

- Worms divided into 3 groups:
  1- Cestodes:
  Tape worm e.g. taenia saginata (beef), taenia solium (pork).
  2- Nematodes:
  1. Filaria: filariasis
4. Round worm: ascaris (can cause GI & respiratory obstruction).
5. Threadworm: strongoloid.
6. Whipworm.
3- Trematodes: Bilharziasis

Nursing considerations:
- Instruct responsible family member how to prevent infestation with pinworm by:
  - Washing hands after toileting + before meals.
  - Keep nails short.
  - Applying antipruritic ointment to/and area to reduce scratching which transfers pin worms.
- Alert all family members to be examined for pinworms.
- Emphasize the need for follow-up examinations to check the results of treatment.

1- Mebendazole: vermox
Class: anthelmintic.
Action: By blocking the glucose uptake of the organism death.
Uses: whipworm, pinworm, roundworm.
Contraindications: Hypersensitivity.
Special concerns: Pregnancy, children less than 2 years.
Side effects: Transient abdominal pain, diarrhea.
Dosage: for pinworm, 1 tablet one time.
Whipworm, roundworm, hookworm 1 tablet morning and evening on 3 consecutive days.
Note: All treatments can be repeated after 2-3 weeks.

2- Niclosamide: Yomesan
Class: anthelmintic.
Action: Inhibit oxidative phosphorylation in the mitochondria of the worm.
The drug is not absorbed from GIT and excreted in feces.
Uses: For tape worm only.
Special concerns: pregnancy, lactation, children under 2 years.
Side effects: nausea, vomiting, anorexia, bad month odor, shin rash, alopecia, dizziness, fever, sweating.
Dose: 2g as a single dose (4 tabs X 0.5 g).
- For hymenolypsnana: 2g as a single dose daily for 7 days.

3- Piperazine: vermizine
Class: anthelmintic
Action: Paralyze the muscle of the parasite dislodge & excretion.
- Absorbed via GIT, metabolize in liver & excreted in urine.
Uses: Pinworm (oxyuriasis), round worm (ascariais).
Note: Recommended for pediatric use.
**Contraindications:** Impaired liver & kidney function, seizures, and hypersensitivity.

**Side effects:** nausea, vomiting, diarrhea, tremors, ataxia, blurring of vision, cataract, bronchospasm, rash.

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**Antitubercular Agents**

- Take more than one drug.
- Every 3-4 months drugs are changed to prevent resistance.
- Treatment usually chronic because of the slow growth of mycobacterium.
- The long duration of drug therapy increases the risk for complications.
- Drugs of T.B. are categorized as 1<sup>st</sup> line and 2<sup>nd</sup> line depending on their efficacy, activity & incidence of side effects.
  * 1<sup>st</sup> line drugs: Ethambutol, Isoniazide, Rifampin, Streptomycin.
  * 2<sup>nd</sup> line drugs: Capreomycin, Kanamycin, PAS.

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**Nursing considerations:**

1- Anticipate that more than one drug will be given at the same time.
2- Don’t administer concomitantly antitubercular agents that are highly toxic.
3- Obtain appropriate lab. data to assess for nephrotoxicity, ototoxicity and hepatotoxicity caused by most of antitubercular agents.
4- Incorporate safety precautions to protect the client manifesting vestibular difficulties during ambulation to prevent falls and injury.
5- Provide clients with the support necessary to encourage them to complete the long period of therapy for cure.
6- Explain the nature of T.B. infection & how to protect others from contracting the disease.
7- Stress the importance of taking prescribed drugs as ordered and of reporting the monthly check-ups and lab. studies.
8- Stress the importance of vision test every 2-4 weeks while on therapy & reassure client that the side effects on eyes generally disappear within several weeks to several months after therapy has been discontinued.

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1- **Aminosalicylate: PAS “para-aminosalicylic acid”**.

   **Class:** 2<sup>nd</sup> line antitubercular.
   **Action:** interfere with folic acid synthesis of susceptible tubercle.
   - Bacteriostatic - absorbed from GIT 50% metabolized + excreted in urine.
   **Uses:** with Isoniazide or streptomycin in treatment of T.B.
   **Contraindication:** Hypersensitivity.
   **Special concerns:** Pregnancy, impaired liver & kidney function peptic ulcer, congestive heart failure.
   **Side effect:** nausea, vomiting diarrhea, thrombocytopenia, leukopenia, hemolytic anemia.

2- **Capreomycin sulfate: Capastat**

   **Class:** 2<sup>nd</sup> line antitubercular.
   **Action:** unknown
   Should be administered parenterally.
3- **Ethambutol Hcl: Myambutol.**

- **Class:** 1st line antitubercular agent.
- **Action:** Tuberculostatic, arrest multiplication of rapidly dividing tubercle bacilli probably by interfering with RNA synthesis.
- Absorbed from GIT & widely spread in body tissues except CSF.
- 65% of metabolized & unchanged drug excreted in urine & accumulate in patients with renal insufficiency.
- **Uses:** Pulmonary T.B. in combination therapy.
- **Contraindications:** Hypersensitivity, less than 13 years of age, & preexisting optic neuritis.
- **Special concerns:** pregnancy, impaired renal function, gout.
- **Side effects:** optic neuritis, loss of color (green) discrimination. Loss of vision (temporary). Peripheral neuritis (tingling). Hyperuricemia.
- **Note:** side effects appear in early months, then disappear.

4- **Isoniazide: INH**

- “Is the most effective tuberculostatic agent”
- **Class:** 1st line antitubercular agent.
- **Action:** interfere with lipid & nucleic acid metabolism of growing bacteria alteration of bacterial wall.
- Absorbed after oral or IM administration & is widely spread in body tissues.
- **Uses:** T.B. caused by human, bovine & BCG. Prophylaxis of T.B.
- **Contraindications:** Hypersensitivity.
- **Side effects:** peripheral neuritis, ataxia, jaundice optic neuritis, thrombocytopnea.
- **Note:** B-complex or pyridoxine 10-15mg \day may be given to CNS side effects.
- Liver function & ophthalmic test are recommended periodically.

5- **Kanamycine: Kantrex.**

- **Class:** 2nd line antitubercular agent, aminoglycoside.
- It is not recommended for children

6- **Streptomycin sulfate:**

- **Class:** 1st line antitubercular agent , aminoglycoside .
- **Dose :** 1g once a day for 1 month , then 1g 2-3 times/week for a minimum of 1 year.
- **Side effects:** ototoxicity, nephrotoxicity, neurotoxicity.

7- **Rifampin: Rifadin, Rimactane**

- **Class:** 1st line antitubercular agent.
- **Action:** suppress RNA synthesis.
Both bacteriostatic + bactericidal
Well absorbed from GIT & widely distributed in body tissues.
Metabolized in liver & excreted in feces.
Uses: Pulmonary T.B. in combination therapy.
In treatment of meningococcal carrier in Neisseria meningitis infection.
Contraindication: Hypersensitivity.
Special concerns: lactation, pregnancy, children less than 5 years old, hepatic dysfunction.
Side effects: Nausea, vomiting, diarrhea, cramps, heartburn ataxia, jaundice, SGOT & SGPT
Hemolytic anemia.
Dose: T.B. 600 mg single dose daily.
Meningitis 600 daily for 4 days.

Leprostatics

Leprosy:
- Causative agent: Mycobacterium Lepri
- Incurable chronic infection of the skin, mucus membrane and nerves.
- Transmitted by direct contact.
- Incubation period (1-3 years).
- Lead to paralysis, disfigurement & deformity.

1- clofazimine: Lamprene.
Class: Leprostatic
Action: Has a bactericidal effect on the mycobacterium, inhibit the growth of mycobacterium by binding to its DNA, it is concentrated in fatty tissues & RES, excreted in feces via bile as well as in sputum, sweat & sebum.
Special concerns: pregnancy, lactation, children, abdominal pain & diarrhea.
Side effects: Nausea, vomiting, abdominal pain, diarrhea.
Dry skin, brownish to black discoloration of the skin, rash, jaundice, lymphadenopathy, SGOT, hypokalemia.
Uses: Dapsone resistant Leprosy.
Dose: 100 mg daily in combination therapy for 3 years.

2- Dapsone: Avlosulfon
Class: leprostatic
Action: unknown, synthetic agent has bactericidal & bacteriostatic activity. Act similarly to sulfonamides.
Uses: Leprosy, prophylaxis of malaria.
Contraindications: Advanced amyloidosis of the kidneys, lactation
special concerns: pregnancy.
Side effects: hemolytic anemia, methemoglobinemia, nausea, vomiting, vertigo, and photosensitivity.
Dose: 50-100 mg \day without interruption for 3 years.

Antimalarials
- Malaria is transmitted by the anopheles mosquito.
- The causative organism is plasmodium- falciparum, vivax, ovale or malariae.
- Transmitted to human through mosquito bite where if travels to human liver to grow and divide.

1- **Aminoquinolines**
   - made up of 2 drugs – a) chloroquine (aralen).
   Two) Hydroxychloroquine (plaquenil).
   - Widely used for treatment of malaria. Synthetic agents resemble quinine.
   - Also used as amebicides.
   - **Action:** are believed to complex with DNA and prevent replication of the organism. Rapidly absorbed from GIT and widely distributed to body tissues.
   - **Uses:**
     * For treatment of malaria.
     * Must be combined with primaquine for radical cure of P. vivax and ovale.
   - **Note:**
     - Only effective on erythrocytic stage it will not prevent infection.
     - Extraintestinal amebiasis caused by entameba ltistolytica.
   - **Untoward reaction:** chloroquine: exacerbate psoriasis, eye toxicity → Retinopathy → blindness.

2- **Aminoquinoline: primaquine phosphate.**
   - **Class:** antimalarial.
   - **Action:** unknown. Bind with and alter DNA and protein synthesis.
   - **Uses:** Active against exoerythrocytic form of vivax and falciparum. Administered with quinine and chloroquine.
   - **Contraindications:** Pregnancy, very active form of vivax and falciparum.
   - **Side effects:** Ocular neuritis, G-6-PD deficiency, arrhythmia, hypertension, abdominal cramp.

3- **Quinine sulfate: Novoquine**
   - **Class:** antimalarial.
   - **Action:** Is a natural alkaloid obtain from the bark of the cinchona tree.
     - Has antimalarial, analgesic, antipyretic effects.
     - Relief muscle spasm.
     - Used increasingly, no resistance forms are found.
     - Its action not known, affect DNA replication.
   - **Uses:** In combination e other antimalarials or sulfadiazine for resistance form of p. falcipatum.
     - Nocturnal leg eczema.
   - **Contraindication:** Patient with tinnitus.
   - **Side effects:** Cinchonism → tinnitus, visual disturbance, nausea, photophobia, diplopia, blurring of vision.
   Cardiovascular, dermatological & GI effects.
Amebicides and trichomonocides

1- chloroquine Hel

2- erythromycin

3- Gentian Violet
   v Class : Topical & vaginal anti-infective.
   v Action: Rosaniline dye is effective against some gram positive bacteria, many fungi & many strains of candida.
   v Treatment should continue until symptoms subside.
   v Uses : Topically for treatment of cutaneous and mucocutaneous candida albicans as thrush, Unlvovaginal candidiasis.
   Candidiasis in general.
   v Contraindications: - Hypersensitivity.
   - Ulcerative lesions of face and vagina.
   v Side effects: irritation, ulceration of mucus membranes, laryngitis, esophagitis, laryngial obstruction, & vaginal irritation.
   v Dose: vaginal; one tampone (5 mg), inserted for 3 hours once or twice daily for 12 consecutive days.
   Topical sol.: 1% - 2% solution to affected area 2-3 times for 3 days.

4- Metronidazole: Flagyl
   Class: systemic trichomonocide, amebicide.
   Action ; - effective against anaerobic bacteria & protozoa.
   - Inhibit growth of trichomona & amebae by binding to DNA & inhibit nucleic acid synthesis → cell death.
   - Well absorbed from GIT & widely distributed in tissues.
   - Eliminated in urine (primarily), 20% unchanged → red, brown discoloration in urine following P.O. or I.V. use.

   Uses:
   A - Systemic:
   1- amebiasis, trichomoniasis. 2- amebic dysentry.
   3- amebic liver abscess. 4- septicemia
   5- Endocarditis 6- Giardiosis
   7- to anaerobic infections of the abdomen following colorectal surgery, hystrectomy, emergency appendectomy.

   B. Topical :
   1. Inflammatory papules & pstules.

   Contraindications:
   - Active organic disease of CNS.
   - Blood disorders
   - Lactation.
   - 1st trimester of pregnancy.
   - Topical Hypersensitivity.

   Side effects: Dry mouth, metallic taste, diarrhea, dizziness abdominal discomfort, furry tongue, ataxia, vertigo & leukopnea.
Dose: 500-750 mg, 3 times daily for 5-10 days.

Nursing considerations:
- If used IV, drug should not be given by IV bolus.
- If a primary IV fluid setup is used, discontinue the primary solution during infusion of metronidazole.
- Report any symptoms of CNS toxicity immediately e.g. ataxia or tremor, which necessitate withdrawal of drug.
- The drug may turn urine brown.
- Explain for the male partner, the necessity to have therapy.

5- Povidone Iodine: Betadine
Class: Antiseptic, germicide.
Action: Is a nonstinging, nonstaining iodine complex with all of the antiseptic properties of iodine but without skin & mucus membrane irritation. Bactericidal for gram –ve & +ve bacteria, antibiotic resistant organisms, fungi, viruses, protozoa & yeast.
Uses: - Topical dressing - Antiseptic for wounds & burns.
- Degerming of skin - Preoperatively.
- Treatment of dandruff.
Contraindications: skin hypersensitivity.
Dose: on full strength (solution or ointment) only once.

Urinary Germicides / Analgesics

UTI may be treated with one of the sulfonamides, antibiotic or drugs discussed in this chapter.

1- Methanamine Hippurate: Hiprex.
Methanamine Mandelate: Mandelamin.
Class: urinary tract anti-infective.
Action: the drug is converted in acid media into amonia and formaldehyde (the active principle) which denaturate protein.
Effective when PH of urine is 5.5 or less (maintained) by hippurate or mandelate.
Uses: acute, chronic & recurrent UTI specially gram –ve organisms
Contraindications: renal insufficiency, liver damage, severe dehydration
Special concern: Pregnancy & gout.
Side effects: nausea, vomiting, diarrhea, anorexia, proteinuria, crysaluria, urinary frequency & urgency.
Note: Na Hco3 effect since it alkalinity of urine.

2- Nalidixic Acid: negram, urogram (quinolone)
Class: urinary germicide.
Action: Inhibit DNA synthesis of the microorganism.
Partially metabolized in the liver & rapidly excreted in urine.
Sensitivity determination is recommended.
Liver & kidney function test- If used more than 2 weeks.
Uses: Acute and chronic UTI.
Contraindications: To be administered with caution in patients with:
- liver disease.
- Impaired kidney function
- Epilepsy
- Pregnancy
- Lactation
- Children
- Cerebral arteriosclerosis.
**Side effect:** Nausea, vomiting, diarrhea, seizure, headache dizziness, leukopenia, thrombocytopenia, hemolytic anemia due to G-6-PD deficiency.

**Dose:** 1g q.i.d. for 1-2 weeks.

3- **Nitrofurantoin: Furadantin**

**Class:** urinary germicide

**Action:** Interfere with bacterial CHO metabolism by inhibiting acetyl COA-enzyme, also interfere with bacterial cell wall synthesis.

Bacteriostatic at low concentration, bactericidal at high concentration.

**Uses:** severe UTI (pyelonephritis, cystitis).

**Contraindications:** anuria, oliguria, impaired renal function.

Pregnancy, lactation, infant less than 1 month of age.

**Special concerns:** used with caution in patients with anemia, DM, electrolyte imbalance, avitaminosis, debilitating disease.

**Side effect:** Nausea, vomiting, pancreatitis, abdominal pain, leukopenia, megaloblastic anemia, headache, vertigo, hemolytic anemia in patients with G-6-PD deficiency.

4- **Norfloxacin: Apirol (quinolone)**

**Class:** urinary germicide

**Action:** Against gram +ve and gram –ve organisms by inhibiting DNA synthesis.

Not effective against obligate anaerobes.

**Uses:** complicated and uncomplicated UTI.

**Contraindications:** Hypersensitivity to negram, lactation, children.

**Side effects:** nausea, vomiting, heartburn, abdominal pain, leukopenia.

**Dose:** Tabs. 400 mg bid for 7-10 days.

Nsg considerations: As those for all anti-infectives.

5- **Phenazopyridine: sedural**

**Class:** urinary analgesic.

**Action:** Azo dye has local anesthetic effect on UTI.

**Uses:** pain relief in chronic UTI, irritation, trauma instrumentation. (Not For Treatment of UTI).

**Contraindications:** Renal insufficiency.

**Side effects:** hemolytic anemia (G6 PD), renal + hepatotoxicitys, nausea. yellow-brownish discoloration of urine.

**Note:** Yellow discoloration of skin +sclera indicates accumulation as a result of renal insufficiency.

**Dose:** 200 mg tid with or after meal.

Treatment of overdose: methylene blue IV or ascorbic acid P.O.

**Nsg consideration:**
- Inform patient that drug may turn urine color into deep yellow or orange color.
- Renal function test is necessary to avoid toxicity.
- Encourage fluid intake.

**Antiviral Drugs**

- Most antibiotics are ineffective against viruses.
Vaccines has been widely used to prevent certain viral infections e.g measles, small pox, polio …. .
- Treatment of AIDS.

1- Acyclovir : Zovirax
Class: Antiviral , anti-infective
Action: Drug is converted to acyclovir triphosphate which interfere with herpes simplex virus DNA polymerase and therefore, inhibit DNA replication.
Uses:
- P.O.: for initial + recurrent herpes infection in immunocompromised & nonimmunocompromised patients.
- Parenteral: initial therapy of severe genital herpes, varicella zoster infection in immunocompromised patients.
- Herpes simplex encephalitis.
- Topical duration of healing in limited nonlife threatening infection.
Contraindications: Hypersensitivity.
Side effects:
P.O nausea, vomiting, anorexia, sore throat.
Parenteral phlebitis, hypotension, skin rash.
Topical Burning pain.
Dose:
Caps. & tabs Initial 200 mg /4 hrs for a total of 5 caps/day for 10 days.
Chronic 200 mg tid for up to 12 months.
IV infusion or ointment.

2- Amantadine; Symmetrel
Class: Antiviral , antiparkinson
Action: Prevent penetration of the virus into cell, may be by preventing uncoating of RNA.
Uses: Influenza A viral infection.
Symptomatic treatment of idiopathic Parkinson.
Parkinsonism syndrome postencephalitis.
Contraindications: Hypersensitivity.
Side effects: Nausea, vomiting, constipation, anorexia, CHE, leukopnea.

3- Idoxuridine: virusan oint. , iduridine eye drops.
Class: ophthalmic antiviral.
Uses: Herpes simplex keratitis.
Contraindications: Hypersensitivity, deep ulceration, and lactation.
Side effects: localized to eye (visual haze, irritation, pain, edema of eye lids, photosensitivity).

4- Zidovudine : AZT, Retrovir
Class: Antiviral
Uses: AIDS, Pneumocystis carinii pneumonia.
Contraindication: Allergy.
Side effect: Nausea, vomiting, anemia, dizziness, headache malaise, diaphoresis.
Antineoplastic Agents

Treatment of tumors:

Chemotherapy:
Antineoplastic or cytotoxic (cell poisons) drugs: toxic and interfere with the growth of normal as well as abnormal cells specially rapidly growing cells e.g bone marrow, GI mucosal epithelium & hair follicles.

Side effects:
- Bone marrow depression → leukopenia, thrombocytopenia, anemia.
- Hair follicles → alopecia.
- GI → nausea, vomiting, stomatitis.

General nursing considerations for antineoplastic agents:
Administration:
- Should be prepared by trained personnel (not by a pregnant).
- Prepared away from cooling or heating vents & other peoples.
- Use latex gloves to protect skin.
- Wash hands before and after preparation.
- Wear non-permeable surgical gown, close front, fit knit cuffs.
- Use piggyback setup with electronic infusion pump.
- Start infusion with solution not contain vesicant agent.
- If possible, not use dorsum of the hand, wrist & antecubital fossa, as a site of infusion & previously used sites.
- After starting unmedicated solution, check for blood return, pain, redness and edema.
- Instruct client to report pain, redness, and edema during & after treatment.
- Intake and output monitoring.
- Report any extravasation to physician & follow policy to minimize effect.

Bone Marrow depression:
1. Leukopenia:
   - Check WBC count and sudden drop less than 2000/mm³.
   - Check temperature ≤ 4 hours, report fever more than 38°C.
   - Assess skin and bodily orifices for signs of infections.
   - Prevent infection by meticulous body care and strict medical asepsis.
   - Provide mouth care every 4-6 hours.
   - Reverse isolation:
     - Private room.
     - Gloves, masks, gowns as ordered.
     - Limit articles brought to room.
     - Infected personnel (staff + visitors) not to inter this room.
   - Change IV infusion every 24 hours, IV site every 48 hours.

2. Thrombocytopenia:
check platelet count less than 150,000 \( \text{mm}^3 \).
Check urine for blood cells, stool for occult blood, skin for petechiae.
Prevent bleeding by minimizing S.C. or IM injections.
Report + document any unusual bleeding after injection.
Advise the client to use safety measures to prevent injury + bleeding.

3. Anemia:
Check hemoglobin & hematocrit values regularly.
Assess for pallor, fatigue & lethargy.
Provide nutritious diet.
Instruct client to take iron & vitamin C supplements.
Assist with blood transfusion.

4. GI toxicity “nausea and vomiting”
Compare client’s nutritional status and weight with baseline established at starting of therapy.
Determine if the client has anorexia.
Premedicating with antiemetic as ordered.
Administering antineoplastics on empty stomach to minimize nausea and vomiting.
Encourage ingestion of dry carbohydrates such as toast before therapy.
Consider like and dislike of the patient.
Encourage intake of high protein diet.
Provide good oral hygiene both before and after meals.
Provide supportive care to keep client comfortable and clean and free from odors.
Correction of electrolytes may be required.

1- Alkylating Agents:
Action: are highly reactive in that under physiologic conditions they donates an alkyl group to biologically important molecules as DNA.
One) Carboplatin: paraplatin.
Class: antineoplastic, alkylating agent.
Uses: ovarian cancer.
Add. Side effects: neurotoxicity, nephrotoxicity.

Two) Busulfan (BUS): myleran
Class: antineoplastic, alkylating agent.
Uses: leukemia.

Three) Cyclophosphamide (CYC): cytoxan
Class: antineoplastic, alkylating agent.
Add. Side effects: alopecia, bone marrow depression, hemolytic cystitis darkening of skin & fingernails.

Four) Ifosfamide: Ifex
Class: antineoplastic, alkylating agent.
Uses: acute leukemia, testicular cancer, malignant lymphomas.
Add. Side effects: hemorrhagic cystitis.

Five) Mechlorethamine HCL: HN: (nitrogen mustard)
Class: antineoplastic, alkylating agent.
Add. Side effects: Hyperuricemia, temporary amenorrhea, herpes Zoster, deafness.
Note: Drug is highly irritating, any contact e skin should be avoided, plastic or rubber gloves should be worn during preparation.

2- Antimetabolites:
Action: Disrupt DNA replication by interfering with an essential step in its synthesis and metabolism.

One) Cytarbine: cytosar
Class: antineoplastic, antimetabolite.
Add. Side effects: cytarine syndrome occurs 6-12 hours following administration manifested by myalgia, fever, and bone pain.

Two) 5- Flurouracil (5-FU):
Class: antineoplastic, antimetabolite.
Uses: systematic: for cancers of stomach, rectum, colon.
Topical: for mucosal leukoplakia. (Ointment).

Three) Mercaptopurine (6- MP):
Class: antimetabolite, purine analog.
Uses: leukemia
Add. Side effects: hepatotoxicity, hyperuricemia.

Four) Methotrexate (MTX): abitexate
Class: antimetabolite, folic acid analog.
Action: similar to sulfonamide, purine and DNA synthesis.
Uses: uterine choriocarcinoma, vesicular mole, leukemia.
In low doses for treatment of rheumatoid arthritis. Action not known.
Note: leucovirin is given as soon as possible to minimize side effects.
Side effects: severe bone marrow depression, hepatotoxicity, hemorrhagic enteritis, transient paresis or seizures.
Given intravenously and intrathecally.

3- Antibiotics:
Action: interfere with RNA, DNA and protein synthesis,
One) Bleomycin
Two) Dactinomycin: actinomycin D
Three) Doxorubicin: Adriamycin.

4- Natural products and miscellaneous agents:
One) Aspiraginase (L-ASP).
Class: antineoplastic, miscellaneous.
Action: isolated from E.coli aspiragin (aminoacid).
Interfere e RNA and DNA synthesis.

Two) Cisplatin:
Class: antineoplastic, miscellaneous.
Side effect: Severe nausea and vomiting.
Note: Hydrate patient by I.V. fluids 8-12 hours before treatment. Zoforan (antiemetic) is to be given to relief nausea and vomiting.

Three) Vinblastine: velbe

Four) Vincristine: oncvin
Class: antineoplastic, miscellaneous, plant alkaloid.
Uses: Hodgkin’s disease, leukemia, lymphoma (IV only).

5- Hormonal and antihormonal antineoplastic agents:
The growth of cancers affecting the male or female reproductive system and the breasts is usually enhanced by the presence of the hormone normally controlling the function of these tissues. Administration of an antihormone or different hormone which alter hormone function by competing for hormone receptors, will inhibit neoplastic growth.

Specific Nursing consideration:
- Assess for insomnia, anorexia, vascular collapse symptoms of hypercalcemia.
- Withhold drug and report elevated serum calcium level.
- Increase fluid intake to relieve hypercalcemia.

One) Diethylstilbestrol: stilphostrol
Class: Estrogen, synthetic, nonsteroidal.
Action: compete with androgen receptor.
Uses: contraceptive (emergency)
Prostatic cancer (palliative).
Contraindication: Breast cancer, thrombophlebitis.
During pregnancy (possible vaginal cancer).

Two) Temoxifen: valodex
Class: anti-estrogen
Action: occupy estrogen binding sites in target tissue (breasts).
Uses: palliative treatment of breast cancer (postmenopausal).
Gynecomastia (to reduce pain & size).

Three) testolactone; testosterone
Class: antineoplastic, androgen.
Action: synthetic steroid related to testosterone.
Contraindication: breast cancer in men.

6- Radio- active Isotopes:

One) chromic phosphate P32: phosphocol P32.
Class: antineoplastic, radio-active isotope.
Uses: treatment of peritoneal or pleural effusion caused by metastasis. Ovarian & prostatic cancer.

Two) Sodium iodide I131: Idotope
Class: antineoplastic, radioactive isotope, antithyroid.
Uses: Hyperthyroidism, thyroid cancer.

Three) Sodium phosphate P32:
Class: antineoplastic, radioactive isotope.
Uses: leukemia, bone metastasis.

Drugs Affecting Blood Formation and Coagulation

1- Antianemic Drugs:
- Anemia: Refers to many clinical conditions in which there is a deficiency in the number of RBCs or in the hemoglobin level within those cells.
- Iron deficiency anemia (hypochromic microcytic)
- Vitamin C (citrus fluids) enhances absorption of iron.
- Megaloblastic anemia (vitamin B12 and folic deficiency).

Iron Preparations:
- A complex of iron and other substances are normally taken orally.
- Sometimes administered parenterally when:
  - Some disorders limiting the amount of drug absorbed by GIT.
  - Patient is unable to tolerate oral iron.
- Iron deficiency is common in infants (low iron in diet), and during pregnancy (increased requirements).

Action: Iron (diet or drug) absorbed from GIT and transport to bone marrow after combining with protein transferrin, to incorporate with hemoglobin.

Uses: prophylaxis and treatment of iron deficiency anemia.

Contraindications: Hemosiderosis, peptic ulcer, enteritis, ulcerative colites and liver cirrhosis.

Drug interactions:
- Antacids decrease absorption of iron.
- Tetracycline diminish affect of tetracycline (absorption).

Side effects: constipation, gastric irritation, and abdominal cramps.
Toxic reaction: (parenteral) nausea, vomiting, peripheral vascular collapse.
Occur within 60 seconds of toxic dose. Symptoms may disappear then reappear after 6-24 hours.

Treatment of iron toxicity:
- Symptomatic treatment.
  Induce vomiting, then give egg and milk.
  Gastric lavage may be done with IV NaHco3 solution to counteract acidosis.
  Give antidote (chelating agent); IV infusion of deferoxamine (desferal).

Nursing considerations:
Take a complete history, including use of antacids.
Ask about any evidence of GI bleeding.
Advise client to take iron with meals to reduce gastric irritation.
Take iron with citrus juices to enhance absorption.
Advise client not to take iron with milk or antacids.
Encourage client to eat a well balanced diet.
Keep drug out of reach of children (extremely toxic).
When administering iron to child, dilute it with water or fruit juice & use a straw to minimize teeth staining.
Discuss with client the possibility of indigestion, changes in stool color (black) and constipation.

One) Ferrus Sulfate: Ferrograd, Eryfer
Class: antianemic, iron
Note:
- Less expensive
- Most effective oral preporation.
- More stable in air.
Dose: Elixir, oral solution, tablets, enteric-coated tablets.
Prophylaxis: 300 mg daily.
Treatment: 300 mg bid.

Two) Iron dextran injection: imferon
Class.: Iron preparation, parenteral.
“The only drug used parenterally”
Uses: IM or IV for iron deficiency anemia when oral administration is not possible.
Side effects: Anaphylaxis, rashes, nausea, vomiting, diarrhea, hypotension, tachycardia, shock.
- IM → brown skin, abscess formation.
- IV → phlebitis.
Nursing considerations:
- Should never be mixed with other medications - or added to parenteral nutrition.
- Obtain vital signs to determine client response to therapy.
- Give the drug IM deeply or IV slowly.
- Prevent staining of skin by using a separate needle.
- Be prepared to assist with treatment of iron intoxication.

Anticoagulants & Hemostaties

Prothrombin (thromboplaston) → thrombin
Fibrinogen (thrombin) → fibrin (insoluble protein).

Several factors participate in blood clotting manufactured by the liver as vitamin K. (Liver disease affect blood clotting)
Many diseases lead defect of coagulation. (hemophilia, C.V. diseases)

**Anticoagulants:**

**Warfarin sodium : coumadine**

**Class:** anticoagulant.

**Action:** prevent the formation of factors II, VII, IX and X in the liver.

**Uses:** prophylaxis and treatment of deep venous thrombosis.

- Prophylaxis from myocardial infarction.

**Contraindications:** Hemorrhagic tendencies - Blood disorders.

- Ulcerative lesion of GIT.
- Impaired renal and hepatic function.
- Severe hypertension.
- Thrombocytopenia.

**Drug interaction:**

- Antacids effect of anticoagulants (absorption)
- Salicylate effect of anticoagulants.

**Side effects:** hemorrhagic accidents.

**Antidote:** vitamin K.

**Nursing considerations:**

- Daily monitoring of prothrombin time is recommended.
- Instruct clients to take the drug before meal.
- Remind clients to wear identification band that states that they are on anticoagulant therapy.
- Advise client to avoid activities that may cause injury.
- Vitamin K should be available
- Food rich in vitamin K should be avoided.

**Heparin:**

**Class:** anticoagulant

- Naturally occurring substance isolated from porcine intestinal mucosa or bovine lung tissue.
- Must be given parentally.
- Doesn’t interfere with wound healing.

**Action:** Potentiate the inhibitory action of antithrombin III on various coagulation factors.
- Inactivate thrombin and prevent the conversion of fibrinogen to fibrin.

**Uses:**

- To prevent extension of clots.
- To prevent thrombi and emboli from recurring.
- Prophylactic from thromboembolic diseases.
- After some types of surgery (cardiac & vascular).
- Prevent clotting during hemodialysis.
- Treatment of DIC (disseminated intravascular coagulation) coronary occlusion after MI.

**Contraindications:**

- Blood disorders with bleeding tendencies (hemophilia).
Suspected intracranial hemorrhage.
Open wounds.
During surgery of the eyes, brain and spinal cord.
Menstruation.
Abortion.

**Side effects:** Hemorrhage.

**Overdose:** nose bleeds , hematuria, petechiae , tarry stool.

**Antidote:** protamin sulfate.

**Dose:** IV or S.C measured in units according to bleeding & clotting time.

**Nursing considerations:**
- Should not be administered IM, administer by deep sc to minimize local irritation and to prolong the action of drug.
- Don’t massage before and after injection.
- Change site of administration.
- Instruct and stress the importance of reporting any signs of active bleeding.
- Use electric razor for shaving, soft bristle tooth brush to decrease gum irritation.
- Patient should be hospitalized for IV therapy.
- Clotting time, PTT should be done before the start of therapy each dose of drug then daily.

**Heparin lock flush solution:**

**Class:** anticoagulant flushing agent.

**Uses:** dilute solution of heparin sodium (100 units/ml) are used to maintain the patiency of indwelling catheter, IVcanula or blood sampling.

**Hemostatics:**
Drugs used to control excessive bleeding.

**Topical Agents:**
1. **Cellulose , oxidized: oxycel gauze**
   **Class:** topical hemostatic.
   **Action:** upon contact with blood, oxidized cellulose form a tenacious (black mass) that adheres to bleeding surface.
   **Uses:** surgery to control moderate bleeding when suturing or ligation is impractical.

2. **Gelatin sponge : Gelfoam.**
   **Class:** topical hemostatic.
   Used during surgery to control capillary bleeding (oral surgery).

**Systemic Agents:**
1. **Aminocaproic acid: amicar.**
   **Class:** hemostatic
   **Action:** inhibit plasminogen & prevent fibrinolysis.

2. **Antihemophilic factor: AHF factor VIII.**
   **Class:** systemic hemostatic.
   **Uses:** hemophilia A (deficiency of factor VIII)
2. **Factor II complex:**
*Class:* systemic hemostatic
*Uses:* Hemophilia B (Christmas disease) deficiency of factor IX.

**Blood, Blood components & Blood substitutes**

**Note:** Before use, check cross-matching test.
**Uses:** Replacement of blood loss (trauma, surgery, disease).
Plasma volume expansion.
Severe clotting defects.
Hemostasis - Burns - Hypoproteinemia.
**Side effects:** viral hepatitis - hypersensitivity reaction - febrile reaction.
- hemolysis (fatal).
- Jaundice (hemolysed RBCs) - hypervolemia.

**Nursing considerations:**
- Don’t use dextrose injection (cause clumping of RBCs).
- Never use distilled water as this will cause hemolysis.
- Never add medication to blood or plasma.
- Review client history.
- Check chart to be certain that the proper blood work has been completed (type & cross-matching).
- Check client name, have 2 professionals verify client and check blood.
- Have available epinephrine, antihistamine, corticosteroids and resuscitation equipment.
- Regulate IV to 20 drops/min, remain with the client to assess for any untoward reactions.
- Stop the infusion immediately, notify the physician if untoward reactions occurred.
- Check vital signs at the beginning, 15 minutes after starting and at the end of transfusion.
- Increase the rate of flow ordered if there are no reactions evident after the first 15 minutes of therapy.

1. **Albumin:**
*Class:* Blood volume expander.
*Uses:* shock, post surgery, nephrotic syndrome, burns, coma, liver cirrhosis, premature infants, hyper bilirubinemia.

2. **Whole Blood:**
*Class:* Blood replacement.
*Uses:* Anemia, hemorrhage, hypovolemia.

3. **Plasma:**
*Class:* Blood volume expander.
*Uses:* Hypovolemic shock, hypoproteinemia.

4. **Packed red cells:**
*Class:* Blood replacement.
Uses: anemia, when it is desirable to replace RBCS without increase in blood volume as in old ages, infants, renal disease.

Thrombolytic Agents

- Agents used to promote the dissolution (lysis) of the insoluble fibrin trapped in intravascular emboli and thrombi.
- The most serious complication is hemorrhage.
- Heparin therapy usually follows treatment with these agents.

1- Streptokinase:
Class: Thrombolytic agent.
Action: Acts with plasminogen to produce an activator complex which enhance the conversion of plasminogen to plasmin which breaks down fibrinogen, fibrin clot & other plasma proteins.
Uses: Deep venous thrombosis (DVT)
Myocardial infarction (MI)
To clear occluded arteriovenous or IV canula.
Contraindication: Hemorrhage.
Side effects: Bleeding, nausea, and headache.

2- Urokinase:
As streptokinase,
Note: Thrombolytic agents should be given within 6 hours of clot formation.

Cardiac drugs

- Cardiac the most effective drugs for treatment of C.H.F.

glycosides

- Digitoxins are plant alkaloids.
- They increase myocardial contractions, which will increase blood supply to all organs including the kidneys therefore causing diuresis, which will decrease the edema.
- They are used to treat cardiac arrhythmia because they decrease heart rate.

Action:
- They increase the force of myocardial contractions (positive inotropic).
- It increase the contractility of the heart muscle by minimizin the movement of Na and K ions and increasing the release of Ca ions in the myocardial cels.
- It decreases the heart rate due to increase in parasympathetic nervous system and decrease in the sympathetic tone.
- They are primprily excreted through the kidneys.
- The initial dose is the larger dose (the loading or digitalizing dose), the subsequent doses are referred to as (Maintenance doses).

Results:
- Decrease in venous pressure.
- Coronary dilatation.
- Reduce heart size.
- Marked diuresis and decreasing edema.

Indications:
2. Cardiac arrhythmia (atrial fibrillation, atrial flutter and sinus tachycardia.

**Contraindication:**
1. Hypersensitivity.
2. Angina pectoris in absence of CHF.
3. Given with caution for elderly and people who have kidney failure.

**Side effects:**
1. They are extremely toxic and may cause death.
2. There is a narrow margin of safety between the therapeutic dose and the toxic dose.
3. Could cause overdose by cumulative effects of the drug so frequent assessment of the serum level is essential.
4. My cause cardiac arrhythmia such as bradycardia (below than 60 beat/minute), ventricular fibrillation (which may lead to cardiac arrest and death), and Bigeminal rhythm.
5. Nausea, vomiting, and diarrhea.
6. Headache, malaise and muscle weakness.
7. Skin rashes, blurring of vision, diplopia and while halos.

**Note:**
- Patients suffering from digitalis intoxication should be admitted to the ICU for continuous monitoring of ECG. Administration of digitalis should be halted.
- If serum potassium is below normal, administer K salts and give antiarrhythmic drugs as Lidocain as ordered by Dr.

**Drug interactions:**
1. Antacid (they decrease the effect of digitalis).
2. Furosemide (Lasix): it increase K loss and increase the chance for digitalis toxicity.

**Predisposing factors for digitalis toxicity:**
1. K loss (hypokalemia) which results from: diuretics, NPO, gastric suction, and poor K intake.
2. Pathological conditions;
   - Liver disease: they decrease metabolism and therefore increase digitalis level.
   - Kidney disease: they decrease the excretion of drug and therefore increase digitalis levels.

**Nursing considerations:**
- Check doctor’s order, medication record and bottle label accurately.
- Observe monitor for evidence of bradycardia or arrhythmia.
- Measure intake and output accurately.
- Weigh the patient in daily basis.
- Pulse should be checked by 2 nurses.
- Provide the client with foods high in potassium as banana, orange.
- Monitor serum digoxin level.
- Elderly people should be assessed for early signs of toxicity.
- Have digoxin antidote available (digoxin immune FAB).

**Drugs:**
1. Digitoxin: crystodigin
   - Class: cardiac glycoside
   - Uses: drug of choice for maintenance in CHF.
Dose: Digitalizing dose is 0.6 mg in 4-6 hours.
Maintenance: 0.05 – 0.3 mg/day.

2. Digoxin: Lanoxin
   Class: cardiac glycoside.
   It is the drug of choice for CHF because of:
   1. It has rapid onset.
   2. It has short duration.
   3. It can be administered P.O. or IV.
   Dose: digitalization dose = 0.4 – 0.6 mg followed by 0.05 – 0.35 mg once or twice daily.

3. Digoxin Immune FAB: (Ovine)
   Class: digoxin antidote.
   Action: antibodies bind to digoxin and excreted through the kidneys.
   Uses: life threatening digitalis toxicity or overdose.
   Note: cardiac arrest can be expected if an adult ingests 10 mg or if a child ingests 4 mg.

Coronary vasodilators
Antianginal drugs

Angina pectoris: is a clinical syndrome characterized by paroxysm of pain in the anterior chest caused by insufficient coronary blood flow an/or inadequate oxygen supply to the myocardial muscle.
Causes: (1) Atherosclerosis. (2) Vasospasm.

There are three groups of drugs used for treatment of angina:
1. Nitrates/nitrites.
2. Beta-adrenergic blocking agents.
3. Calcium channel blocking agents.

Nitrates/nitrites:
- Nitrates/nitrites - Action: direct relaxation of blood vessels and smooth muscles vasodialtion - O2 requirements - relaxation of smooth muscles of coronary arteries - coronary vasodialtion - blood supply to the myocardium.
- relaxation of arteries and veins - BP - workload in the heart.

Objectives of treatment:
1. Treatment of anginal attack and thus relief pain.
2. Prophylactic treatment to prevent or delay the occurrence of MI.
3. Prolongs intervals between attacks.

Indications:
1. Prophylaxis and treatment of acute angina pectoris.
2. Treatment of chronic angina pectoris.
3. Testamant of hypertension associated with MI or CHF.

Contraindications:
3. Sever anemia.
4. Hypotension.
5. Head trauma.
6. Cerebral hemorrhage.

**Side effects:**
1. Headache, syncope, dizziness.
2. Postural hypotension, transient flushing, and palpitation.
3. Topical application may lead to dermatitis.

**Drug interaction:** Antihypertensive agents, Beta-adrenergic blocking agents, and calcium-channel blocking agent (they may lead to additive hypotension.

**Dosage:** there are several forms available:
1. Sublingual: Cordil 5 mg PRN.
2. PO: Isotard 20 – 40 mg twice a day.
3. Topical: available as patches or ointment.
4. Parental (IV infusion).

**Nursing considerations:**
1. Medications should be taken on an empty stomach.
2. Carry sublingual tablets in a glass bottle, tightly capped.
3. If anginal pain is not relieved in 5 minutes by first sublingual tablet, to take up to 2 more tablets at 5 minutes interval. If pain has not subsided 5 minutes after the 3rd tablet, client should be taken to the emergency room.
4. Take sublingual tablets 5-15 minutes prior to any situation likely to cause anginal pain such as climbing stairs.
5. Take sublingual tablets while sitting to avoid postural hypotension.

**Isosorbide dinitrate:**
- Present in the forms of capsules chewable, sublingual, tablets.
- **Trade names:** Isoral, Cordil, Isotard.
- **Class:** coronary vasodilator.
- **Dosage forms:** caps 20-40 mg, tabs 20-40 mg.
- **Uses:**
  - Tabs for only prophylaxis of anginal pain.
  - Chewable, sublingual to terminate acute attack and relieve acute pain.
  - Esophageal spasm.
- **Side effects:** Headache, hypotension.
- **Dosage:**
  - Sublingual: acute attack 2.5-5 mg Q 2-3 hrs.
  - Oral caps/tabs: 5-20 mg Q 6 hrs.
  - Extended release tabs: 20 –80 mg Q 8-12 hrs.
  - **Note:** Isosorbide mononitrate given for patients with liver impairments.

**Calcium channel blocking agents:**
- **Action:** for contraction of cardiac and smooth muscle to occur, extracellular calcium must move into the cell through openings called calcium channels. These
agents inhibit the influx of calcium through the cell membrane resulting in a depression of automatically and conduction velocity in both smooth and cardiac muscles leading to:

1. Myocardial contractility.
2. Inhibit spasm of coronary arteries dilatation.
3. Peripheral vasodilatation peripheral resistance.
4. S. A. node automatically and conduction heart rate.

**Diltazem HCl: Cardiazem, dilatam.**
- Class: calcium channel blocking agent (anti-angina, antihypertensive).
- Uses: vasospastic angina, essential hypertension.
- Contraindications: hypotension, pulmonary congestion, and MI.
- Side effects: AV block, bradycardia, CHF. Hypotension.
- Dosage: 30 mg qid before meals and at bedtime.

**Nifedipine: Adalat**
- Class: calcium channel blocking agent (anti-angina, antihypertensive).
- Uses: vasospastic angina, essential hypertension.
- Contraindications: hypersensitivity, lactation.
- Side effects: pulmonary and peripheral edema, MI, hypotension, headache, muscle cramps.
- Dosage: 10-30 mg tid.
- In hypertensive emergencies: 10-20 mg given orally or sublingually by puncturing the capsule and squeezing contents under the tongue.

**Verapamil: Ikacor**
- Class: calcium channel blocking agent (anti-angina, antihypertensive).
- Uses:
  - P.O: angina pectoris.
  - arrhythmia (atrial fibrillation, and flutter).
  - Essential hypertension.
- IV: supraventricular tachycardia.
- Contraindications: hypotension, cardiac shock, and MI.
- Side effects: AV block, bradycardia, headache, dizziness, abdominal cramps, blurring of vision, and edema.
- Dosage: Initial 80-120 mg tid then 240-480 mg /day.

**Nursing considerations for calcium channel blocking agents:**
1. Discuss with the patient/family the goals of therapy.
2. Teach them how to take pulse and blood pressure. Hold the medication in case of hypotension or bradycardia and consult the treating Dr.
3. Instruct the client to report any untoward sings as dizziness.
4. In case of postural hypotension, advise the client to change position.
Advise client to sit down immediately if fainting occurs.

Caution: Calcium antagonists should be taken with meals to prevent GI irritation.

Beta-adrenergic blocking agents:
Will be discussed later.

Peripheral vasodilators:
Isoxsuprine:
Trade name: Vasodin.
Class: peripheral vasodilator.
Action: Direct relaxation of vascular smooth muscles increasing peripheral blood flow, the drug also has a cardiac stimulation and uterine relaxation effect “Alpha receptor blocking and Beta receptor stimulation.
2. Buerger’s disease.
3. Raynaud’s disease.
Contraindications: postpartum period, arterial bleeding.
Side effects: tachycardia, hypotension, chest pain, nausea, vomiting, rash, dizziness.
Dosage: 10-20 mg 3-4 time daily.

Papverine:
Class: peripheral vasodilator.
Action: direct spasmolytic effect on smooth muscle and vascular system, bronchial muscle, GI & urinary tract.
Uses:
1. Cerebral and peripheral ischemia.
2. Smooth muscle relaxant/
3. Paraenteral use for: Acute MI and Angina pectoris, Pulmonary embolism, and ureteral, biliary, & GI colic.
Side effects: Flushing of face, hypertension, tachycardia, constipation, dry mouth and throat, headache.

Antihypertensive drugs
Hypertension: is a condition in which the mean arterial blood pressure is elevated.
Essential hypertension: could be mild, moderate, or severe and may lead to dangerous changes in kidneys, eyes and blood vessels.
Secondary hypertension: a certain disease or condition leads to elevation of blood pressure such as toxemia or pregnancy, acute kidney failure, etc.
Antihypertensive agents: are initiated when diastolic blood pressure is higher than 90mm/Hg.
Treatment of hypertension includes:
1. weight reduction. 2. Sodium restriction.
3. Alcohol restriction. 4. Stop smoking.
Single drug should be considered from the following classes:
1. Diuretics.  
2. Beta-blocking agents.  
3. Calcium channel blocking agents.  
4. Angiotesin converting enzyme inhibitors.

Initial therapy is continued for one month. If there is no response, combination therapy is needed.

Nursing considerations:
1. Determine base line blood pressure before starting antihypertensive treatment.
2. Evaluate the extent of the client’s understanding of the disease and the therapy.
3. Ascertain lifestyle changes.
4. Determine client’s ability to take his BP measurement.
5. Record significant changes in BP readings.
6. Advise client to adhere to low sodium diet.
7. Explain the importance of adhering to treatments plan.
8. Teach the patient/family how to measure intake and output.

Angiotensin-converting enzyme inhibitors:

Captopril:
- Trade name: Capotin, nhabace.
- Class: antihypertensive, inhibitor of angiotensin synthesis.
- Action:
  - Captopril is a highly specific competitive inhibitor of angiotensin I converting enzyme. The enzyme is responsible for the conversion of angiotensin I to angiotensin II which decrease BP.
  - Reduce peripheral arterial resistance.
  - Decrease aldosterone secretion which works to increase level of serum potassium.
- Indications:
  1. Hypertension.
  2. In combination with diuretics and digitalis in the treatment of CHF.
- Contraindication: Hypersensitivity, renovascular disease and pregnancy.
- Side effects:
  - Skin rash, loss of taste, neutropnea, nausea, vomiting, hypotension, proteinuria, renal failure and hyperkalemia.
- Dosage:
  - Tablets: 12.5 mg 2-3 time per day.
  - If there is no response, after 1-2 weeks, increase dose to 25 mg 2-3 time per day.
- Nursing considerations:
  1. In case of overdose, give normal saline to restore BP.
  2. Should not be discontinued without Dr. order.
  3. Obtain baseline hematological studies, liver & renal functions tests prior to beginning the treatment.
  4. Determine client’s understanding of the therapy and if he/she takes other medications.
5. Observe client closely for hypotension 3 hours after the initial dose.
6. In case of hypotension, place client in supine position and give IV saline infusion.
7. Withhold potassium sparing diuretics and consult with physician (hyperkalemia may occur).
8. Take captopril 1 hour before meal or on an empty stomach.
9. Report skin rash, heartburn, and chest pain to physician.
10. Explain to client that he may develop loss of taste for 2-3 months, if it persist, notify the physician.

2. Beta-adrenargic blocking agents:
   - **Action**: it combines with beta-adrenargic receptors to block the response to sympathetic nerve impulses, circulating catecholamines or adrenargic drugs.
   - β-adrenergic receptors have been classified as beta 1 (in the cardiac muscle) and beta 2 (in the bronchi and blood vessels).
   - Blocking of β1 receptors → HR, myocardial contractility and cardiac output → BP.
   - Blocking of β2 receptors → airway resistance (bronchospasm), and vasoconstriction.
   - These drugs could be selective (working on one receptor such as β1 selective drugs (Atenolol) or it could be nonselective (such as Propranolol)

**Uses:**
1. Hypertension,
2. Anginal pectoris.
3. Cardiac arrhythmias.
5. Prophylaxis of migrin.

**Contraindications:**
Bradycardia, C.H.F., cardiogenic shock, diabetes, thyrotoxicosis, chronic bronchitis, asthma, bronchospasm, emphysema.

**Side effects:**
Bradycardia, C.H.F., hypotension, cold extremities (due to peripheral vasoconstriction), edema, dyspnia, shortness of breath, nausea, vomiting, hepatomegaly and bronchospasm.

**Treating overdose:**
1. Inducing vomiting, gastric lavage.
2. Artificial respiration.
3. Give atropine sulfate 0.6 mg (up to 3 mg) and glycogen for the treatment of bradycardia.
4. Treat hypoglycemia and hypokalemia.
5. I.V fluids.
6. Adrenaline or dopamine to increase Blood pressure.

**Nursing considerations:**
1. Instruct patient/family to take blood pressure and pulse.
2. Provide written instructions as when to call physician (e.g. HR below 50 beat/min).
3. Consult the physician before interrupting the therapy.
4. Some drugs lead to blurring of vision, so that tell patients not to engage in activities need mental alertness.
5. Instruct patient to dress warmly during cold weather.
6. Diabetic patient should be very careful about symptoms of hypoglycemia.
7. Report any asthma-like symptoms.

**Atenolol:**
Trade name: Normatin.
Classification: Beta-adrenergic blocking agent
Classification: Beta 1-adrenoreceptor blocking drug which is a cardioselective.
Uses: Hypertension angina pectoris.

**Dosage:**
Tablets: 50 mg or 100 mg daily
Initial dose is 50 mg, if there is no response, increase dose to 100 mg daily.
IV in case of acute MI: give 5 mg over 5 minutes, and if there is no response, give another 5 mg after 10 minutes.

**Specific nursing considerations:**
3. For IV use, the drug may be diluted in sodium chloride, dextrose, on dextrose saline.

**Valolol:**

- **Trade name:** Corgard
- **Class:** Beta-adrenergic blocking agent.
- **Action:** manifests both beta 1 and beta 2 adrenergic blocking.
- **Uses:** hypertension, angina pectoris.
- **Dose:** 40-80 mg daily.

**Propranolol hydrochloride**
Trade name: Inderal, Deralin
Classification: beta-adrenergic blocking agent, antiarrythmic.
Action: manifests both beta 1 and beta 2 adrenergic blocking activity.

**Indication:**
1. Angina pectoris.  
2. Hypertension.  
3. Cardiac arrhythmias.  
4. Prophylaxis of migrin.  
5. Prophylaxis of MI.  
6. Pheochromocytoma

**Additional side effects:** psoriasis-like eruptions.

**Dosage:**
Tablets: initial dose of 40 mg bid, then 120-240 mg in 2-3 divided doses.

**Temolol maleate:**
Trade name: Blocadren, Timpotic.
Classification: Ophthalmic agent, beta-adrenergic agent.
**Action:** both beta1 and beta 2 receptors blocking activity.

**Uses:**
Tablets: for hypertension.
Ophthalmic solution: chronic open angle glaucoma.

3. Centrally acting agents:-
Used for treatment of chronic hypertension, since it affects CNS.

Clonidine Hydrochloride:-
- **Trade name:** (Catapres)
- **Classification:** Antihypertensive, centrally antiadrenergic agent.
- **Action:** stimulates alpha-adrenergic receptors of CNS → inhibition of sympathetic vasomotor centers & nerve impulses ↓ HR & BP.
- **Uses:** treatment of mild to moderate hypertension.
- **Side effects:** Drowsiness, headache, malaise, dry mouth, bradycardia, and constipation.
- **N.B.** If colonidine is D.C abruptly, rebound hypertension may occur.
- **Dosage:** Initially 0.1 mg bid , then increased to 0.1 - 0.2 mg daily until desired response is obtained.

Methyldopa :-
- **Trade name:** (Aldomin)
- **Classification:** Antihypertensive, centrally acting antiadrenergic agent.
- **Action:** The active metabolite alphamethylenorepinephrin lowers BP by stimulating central inhibitory alpha-adrenergic receptors.
- **Uses:** Hypertension & hypertension crises (parenteral).
- **Contraindications:**
  1. Hypersensitivity,
  2. Active hepatic diseases.
  4. Pheochromocytoma.
- **Side effects:**
  - Headache, dizziness, general weakness, depression and sedation.
  - Bradycardia, orthostatic hypotension.
  - Dry mouth, nausea, vomiting, sore (black) tongue.
  - Jaundice, liver disorders.
  - Hemolytic anemia, & leukopena.
  - Male impotence.
- **Dosage:**
  - **Tabs.** - initially 250 mg bid or tid.
- **Nursing considerations:**
  1. Avoid activities that need mental awareness such as driving.
2. Note any evidence of jaundice and do liver function test on intervals.

3. Advise pt. to rise from the bed slowly.
4. Instruct pt. about reportable Signs & Symptoms
5. Explain to pt. that urine rarely may be turn into dark / blue color.
6. Advise client to carry a card detailing current medication regimens always.

4. **Peripherally acting drugs:-**

   - Guanethidine sulphate:
     - **Trade name:** (Ismelin)
     - **Classification:** antihypertensive, peripherally acting antiadrenergic agents.
     - **Action:** selective adrenergic blockade of efferent, peripheral sympathetic pathways by depleting norepinephrine reserve & inhibiting norepinephrine release. Decrease hypertension gradually. HR.
     - **Uses:** treatment of hypertension.
     - **Contraindications:** Pheochromocytoma, C.H.F.
     - **Side effects:** Dizziness, postural hypotension, bradycardia, edema and C.H.F.
     - **Dosage:**
       - Initial dose, Tabs: 10-12.5 mg once daily.
       - Maintenance dose: 25-50 mg once daily.

5. **Agents that act directly on vascular smooth muscles:**

   - Hydralazine hydrochloride:
     - **Trade name:** (Apresoline)
     - **Classification:** Antihypertensive, direct action on vascular smooth muscles.
     - **Action:** directly affect smooth muscles. Vasodilation, cardiac output and finally blood flow to the brain and kidneys.
     - **Uses:** used with combination therapy to treat hypertension. Given **parenterally** in hypertension emergencies.
     - **Contraindications:**
       - Angina pectoris.
       - Rheumatic heart disease.
       - Chronic glomerulonephritis.
       - Systemic lupus erythematosus (S.L.E.)
     - **Side effects:**
       - Orthostatic hypotension, tachycardia, nausea, vomiting.
       - Headache, dizziness, constipation and male impotence.
     - **Dosage:**
       - Tabs: initially 10 mg qid for 2-4 days, then 25 mg bid
- I.V, I.M :- 50 mg (IV slowly) repeated as necessary. (may decrease Bp in 5 minutes.)

*** Antiarrhythmic agents ***

Cardiac arrhythmias:- altered patterns of contraction or marked increased or decreased HR reducing the ability of the heart to pump blood.

Examples:-
Premature ventricular beats, atrial flutter, atrial fibrillation, ventricular fibrillation-----

N.B:- The effective treatment of arrhythmias depends on:
1) Accurate diagnosis.
2) Changing the causative factor.
3) Appropriate selection of an antiarrhythmic drugs.

Aniodarone hydrochloride:-
Trade name:- (Procor)
Classification:- Antiarrhythmic
Action:- increases the duration of the myocardial cell action potential as well as alpha & beta antiadrenergic effect.

Indications:
- Should be reserved for life threatening ventricular arrhythmias which don’t respond to other therapy.

Contraindications:
- Sensitivity.
- Sinus bradycardia
- AV block
- Thyroid dysfunction

Side effects:
- Bradycardia, CHF, Fatigue, tremors.
- Visual disturbances, photophobia, dry eyes.
- Hemolytic or aplastic anemia.
- Hepatotoxicity.

Dose:
- Tabs 200 mg.
- Maintenance dose: 200-400 mg daily.
- IV infusion: 5 mg/kg over 20-120 minutes.

2- Lidocaine Hydrochloride:
Trade name: xylocaine – Esracain
Class: antiarrhythmic.
Action: shortens the refractory period & suppresses the automatically of ectopic foci without affecting conduction of impulses through cardiac tissue.

Indications: acute ventricular arrhythmias as which follow MI or cardiac surgeries.

Contraindications:
- Hypersensitivity
Heart block.

**Side effects:** hypotension, bradycardia, dyspnea, dizziness.

**Dosage:** available in ampules of a concentration of 1% (100mg), 2% (200mg)

- Loading dose: IV. Bolus 50-100 mg at rate of 25-50 mg/min
- Infusion: 20-50 mg/kg at a rate of 1-4 mg/min.

**Nursing considerations:**
1. Don’t add lidocain to blood transfusion assembly.
2. Make certain that vials state “for cardiac arrhythmias”.
3. Use 5% dextrose solution to prepare drug (stable for 24 hours).
4. Assess for history of hypersensitivity.
5. Use electronic infusion device to regulate the infusion of the drug.
6. Obtain B.P., Pulse, Resp. rate to use as baseline data to evaluate response to treatment.
7. Drug should be given in a monitored environment.
8. Assess B.P. frequently during administration.
9. Assess for respiratory depression.
10. If adverse reactions occur, discontinue infusion & prepare for emergency management.

3. Phenytoin

**Trade name:** Dilantin

**Class:** anticonvulsant, antiarrhythmic.

**Action:** acts in the motor cortex of the brain to reduce the spread of electrical discharges from the rapidly firing epileptic foci in this area. Also activity of centers in the brain stem responsible for the tonic phase of grand mal seizures.

**Uses:**
- Chronic epilepsy.
- Premature ventricular contractions.
- Tachycardia.

**Contraindications:**
- Hypersensitivity.

**Side effects:**
- Drowsiness, ataxia, dizziness, measles-like rash, gingival hyperplasia, Hirsutism (excessive hair growth), hypoglycemia.

**N.B:** - rapid I.V. administration - Hypotension & arrhythmia.

**Dose for arrhythmias:**
- Tabs 200-400 mg daily.
- I.V. 100 mg q 5 minutes up to a maximum of 1g.

**Nursing Considerations:**
1. I.V. phenytoin may form a precipitate, so flush tubing by saline (not dextrose) before & after administration.
2. Assess for hypersensitivity.
3- If a pregnant woman takes this drug, tell her not to breast-feed her baby.
4- Obtain liver & kidney function studies.
5- Monitor serum drug levels on a routine basis.
6- During I.V. therapy, monitor B.P. for signs of hypotension.
7- Take food to minimize GI upset.
8- If the patient is diabetic, monitor for signs of hypoglycemia.
9- Oral hygiene to minimize bleeding from the gum.
10- Report any excessive growth of hair.

4. Procainamide:
**Trade name:** procan
**Classification:** antiarrhythmic
**Action:** produce a direct cardiac effect to prolong the refractory period of the heart & depress the conduction of the cardiac impulse.
**Uses:**
- ventricular tachycardia.
- Atrial fibrillation.
- Digitalis intoxication.
**Contraindication:** Hypersensitivity, complete AV heart block.
**Side effects:** Hypotension, abdominal pain, bitter taste.

5. Propranolol
6. Verapamil

**Drugs affecting The Central Nervous system**

**Barbiturates:**
- **Phenobarbital:**
  **Trade name:** Luminal.
  **Class:** sedative- anticonvulsant- barbiturate.
  **Action:**
  - Long-acting barbiturate- act as a sedative- hypnotic and anticonvulsant by producing CNS depression.
  - It increase the inhibitory activity of the on nerve synapses.
  **Uses:**
  1- Preanesthetic medication.
  2- Sedation
  3- Hypnotic
  4- Epilepsy
  5. in tetanus & eclampsia ( as anticonvulsant).
  **N.B.:** should be given parenterally for anticonvulsant effect.
  **Contraindication:** Hypersensitivity.
  **Side effects:** Headache, fever, megaloblastic anemia, dizziness, hypotension, nausea, vomiting epigastric pain.
  **Forms and Dose:**
  Tablets 100mg, ampules 130mg in 1 cc
  Sedation: 30-120 mg daily in 2-3 divided doses.
  For adults: Hypnotic 100-320 mg at bed-time.
  Anticonvulsant: I.V. 100-320 mg, repeated as necessary.
  Preoperative sedation: I.M. only 130-200 mg – 60-90 minutes before surgery.
N.B: Luminal can be used in neonates as antihyper- bilirubinemia.

Overdose:
Manifested by tachycardia, hypothermia, coma, respiratory depression, absent reflexes & circulatory collapse respiratory relaxation unseals and vascular collapse.

Treatment of overdose toxicity:
1- Maintain & assist respiration as indicated.
2- Support circulation by vasopressor & I.V. fluids as required.
3- Aspirate stomach content, take care to avoid pulmonary aspiration.
4- Diuretics may be given as ordered.
5- Intake & output measurement.
6- Dialysis if indicated.

Nursing considerations:
1- If given I.V, closely monitor the rate of flow. Rapid administration may lead to respiratory depression.
2- Monitor the site of I.V. for soft of extravasation which cause severe pain, nerve damage & necrosis.
3- Avoid the use of alcoholic beverages.
4- Instruct the client not to drive a car or operate other hazardous machinery after taking the medication.
5- Take the medication only as prescribed.
6- Teach patient about sings and symptoms of toxicity, and instruct patient to report them to treating physician.
7- If taken for 8 weeks or more, instruct patient not to stop it suddenly to avoid withdrawal symptoms as convulsion.
8- Keep the drug out of reach of the children.

Secobarbital:
Trade name: seconal
Class: sedative – hypnotic, barbiturate type.
Action: short acting barbiturate, (as luminal).
Uses: short-term of insomnia.
- Sedative to relief anxiety.
- Preoperative sedation.
- Some times parenterally as anticonvulsant.
Dose: tab. 100 mg at bedtime.

Nonbarbiturate sedative-hypnotics:
Paraldehyde:
Trade name: paral
Class: nonbarbiturate sedative-hypnotic.
Action: as barbiturates (luminal), is a bitter fasting liquid & has a strong unpleasant odor, in usual doses it has no or little effect on respiration & blood pressure.
Uses:
- Sedative & hypnotic.
- Emergency treatment of seizures.
- Delirium tremors.
**Contraindication:** - Gastroenteritis - bronchopulmonary disease.
- Hepatic insufficiency.

**Side effects:** skin rash, pain at injection site, bradycardia.

**Anti-anxiety Agents***
- Temazepam
- Lorazepam
- Alprazolam

**Diazepam:**
**Trade name:** Valium, assival
**Class:** antianxiety agent, benzodiazepine.
**Action:** the anxiolytic effect is believed to be mediated through the action of benzodiazepine to increase the inhibitory action of GABA “Gamma aminobutyric acid” inhibit CNS neurotransmitter.
- The drug is metabolized in the liver & excreted through urine.

**Indications:**
1- Symptomatic relief of anxiety & tension.
2- Alcohol withdrawal.
3- Muscle relaxant.
4- Anticonvulsive.
5- Preoperatively.
6- Before gastrescopy or esophagoscopy.
7- Treatment of status epilepticus.
8- Relief of facial muscle spasm.

**Contraindications:**
- Hypersensitivity.
- Acute narrow angle glauccma.
- Pregnancy.
- Shock, coma.
- Alcoholic intoxication (to avoid respiratory of depression).

**Side effects:**
Drowsiness, fatigue, ataxia, hypotension, visual disturbances, headache, phlebites at injection site.

**Dosage:**
- Ampules of 2 ml containing 10 mg.
- Tablets 2 mg, 5 mg or 10 mg.
- I.V. or I. M. 2-20mg depenoling on the indication.
- Tablets 2-10 mg 2-4 times daily.

**Nursing Considerations:**
- Stress that drug may reduce pt’s ability to handle dangerous equipment.
- Avoid alcohol ingestion.
- Don’t stop taking the medication suddenly, withdraw drug gradually.
- Monitor B.P. before & after administration.

**Antipsychotic Drugs***
**Chlorpromazine:**
**Trade name:** largactil
**Class:** Antipsychotic, phenothiazine.
**Action**: Act by blocking dopamin receptors. It has significant antiemetic effect, hypotensive, sedative & anticholenergic effect.

**Uses**:
- Acute & chronic psychodsis (such as schizophrenia, mania & manic depression.
- Preanesthetic.
- Intractable hiccoughs.
- Nausea & vomiting.

**Contraindication**:
- Severe depression, coma.
- Bone marrow depression.
- Patients with history of seizures & on anticonvulsant therapy.
- Hepatic & renal diseases.
- Prostatic hypertrophy.
- Dehydration, glaucoma, measles.

**Side effects**:
Depression, dizziness, seizures, gynecomastia. Orthostatic hypotension, bronchospasm, larynospasm, tardive dyskinesia, photosensitivity, leukopenia, aplastic anemia, and dry mouth.

**Dose**:
Tablets 10-25 mg 2-4 times a day.
I.M. 25-50 mg repeated after 1 hour if needed.

**Nursing considerations**:
- Shouldn’t be used to treat nausea & vomiting in children less than 6 months of age.
- Should avoid getting solution on hands or clothing (it will cause dermatitis).
- Solutions with marked discoloration should be discarded.
- Note any history of seizures.
- Take liver & kidney function test periodically.
- Document & rotate injection sites.
- Report side effects immediately.
- Determine age of male patients & assess for prostatic hypertrophy.

**Fluphenazine Decanoate**:

**Trade name**: modecate.
**Class**: antipsychotic, phenothiazine.

**Action**: is accompanied by a high incidence of extrapyramidal symptoms & low incidence of sedation, anticholenergic, antiemetic & orthostatic hypotension.

**Uses**:
- Psychotic disorders.
- For chronic pain in conditions such as diabetic neuropathy & patients trying to withdraw from narcotics.

**Doses**:
P.O. or I.M.
Tablets: 2.5 – 10 mg / day in divided doses (3-4 times).
I.M.: 12.5 – 25 mg can be repeated /1-3 weeks.

**Thioridazine**:
Trade name: mellaril
Classification: Antipsychotic – phenothiazine.
Uses:
  - Schizophrenia, depression, anxiety, alcohol withdrawal, intractable pain
  - sleep disturbances.
Action: probably related to drug’s antidopaminergic effects.
Dose: P.O.: 25 mg tid.
Side effects:
  - Headache, tardive dyskinesia, blurring of vision, dry mouth, skin
  - rashes, and photosensitivity.
Contraindications:
  - Comatose patients.
  - Parkinson’s disease.
  - Sever hypertension or hypotension.
Nursing considerations:
  - Monitor vital signs before beginning therapy & at regular
  - intervals.
  - Administer medication with meals to minimize GI upset.

Antianxiety drugs
  Chlordiazepacide :
Trade names: librium, lipoxide.
Class: antianxiety agent.
Action:
  - Depress subcortical levels of CNS, particularly the limbic system.
  - (cortex). It inhibits sensory input in CNS.
Uses:
  - Anxiety
  - Acute withdrawal symptoms of chronic alcoholic.
  - Preoperatively.
  - Sedative, hypnotic.
Side effects:
  - Drowsiness, fatigue, ataxia, dizziness jaundice, hepatic dysfunction.
Dose: P.O. 5-25 mg tid or qid.
Contraindications: coma, shock, lactation, pregnancy.
Nursing considerations:
  - Monitor vital signs.
  - Don’t mix it with any medication.
  - Administer oral medications with food.
  - When given I.V., should be administered slowly.
  - When given I.M or I.V., dilute with water, don’t shake the vial to
  - mix it.
  - Inject deep into large muscle.

Haloperidol:
Trade name: Haldol
Class.: antipsychotic.
Action:
  - Block dopamine receptors —sedation.
- Alpha-adrenergic blockade \( \rightarrow \) the release of growth hormone & the release of prolactine.
- Anticholinergic effect \( \rightarrow \) sedation & orthostatic hypotension.

**Uses:**
- Psychotic disorders such as
- Mania
- Drug induced psychoses.
- Schizophrenia.
- Aggressive & agitated patients. (mental retardal)
- Short-term W of hyperactive children.
- Treating symptoms of dementia in elderly peoples.

**Dose:**
- P.O. 3-5 mg bid –tid.
- I.M. 2-5 mg q 4-8 hrs.
- In sever situations: I.V. 2-25 mg every 30 minutes.

**Side effects:**
Headache, tardive dyskinesia, hypotension, dry mouth photosensitivity, skin rashes, Nausea, vomiting, and constipation.

**Contraindications:**
- Pregnancy
- Lactation
- Shock
- Bone marrow depression
- Hepatic & renal insufficiency.

**Nursing considerations:**
- Monitor vital signs before & during therapy.
- Administer oral medication with food.
- Administer IM deep into large muscle.
- Don’t mix it with any other drugs.
- If concentrated drug is spilled on skin, wash it immediately to prevent dermatitis.

**Lithium carbonate:**
**Trade name:** lithium.
**Class:** antipsychotic, antimanic.

**Action:**
Action is not known. Theories trying to explain the action of this drug include effectiveness to an alteration in Na ion metabolism within nerve & muscle cells “ +K ion & ATP ase” in catecholamine neurotransmitter levels hyperactivity.

**Uses:**
- Control of manic and hypomanic episodes in manic depression patients.
- Prophylactic of bipolar depression.

**Dose:** P.O. 600 mg tid or qid.

**Side effects:**
Drowsiness, dizziness, hand tremors, lethargy. Hypothyrsidism, ECG changes, anorexia, dry mouth, nausea, vomiting, polyuria, leukocytosis, slurred speech.
In case of toxication (blood level over 2.0 mmol/L): hyper-reflexia and hyperextension of limbs, convulsions, toxic psychosis, syncope, oliguria, circulatory failure, and coma.

**Contraindications:**
- Cardiovascular, renal diseases.
- Grain damage.
- Pregnancy & lactation.
- Dehydration.
- Patients receiving diuretics.
- Sodium depletion.

**Nursing considerations:**
- Monitor serum level of lithium every 1-2 weeks to prevent toxicity (normal level is 0.4 - 1.0 mmol/L and toxic level is above 1.5 mmol/L).
- Monitor for pulse irregularities & changes in B.P.
- Provide diet adequate in sodium.
- Monitor for signs & symptoms of toxicity.
- Avoid factors that enhance toxicity: dehydration, renal failure, infection, co-administration of diuretics, and sodium depletion (may occur with diuretics).
- Maintain adequate fluid and sodium levels.
- Withdrawal (stopping) drug should be gradual (over weeks)

**Antidepressants**

1. **Monoamine oxidase (MAO) inhibitors:**

*N.B.: They are highly toxic, prescribed only if tricyclic compounds are ineffective. They also may interfere with detoxification mechanisms which occur in the liver.*

**Action:**
- MAO is one of the enzymes that break down biogenic amines (Norepinephrine, epinephrine & serotonin).
- These drugs prevents this process therefore amines accumulate in the presynaptic granules the concentration of neurotransmitters nerve stimulation antidepressant effect.

**Uses: individualized.**

**Contraindications:**
- Hypersensitivity.
- History of liver disease.
- Pheochromocytoma.
- Impaired renal function.
- Hypertension.
- Epilepsy.
- Hyperthyroidism.
- Glaucoma.

**Side effects:**
- Headache, dizziness, ataxia, euphoria, agitation, hyperreflexia.
- Urinary retention, jaundice, skin rashes, glaucoma.
- Constipation, diarrhea, nausea.

**Nursing considerations:**
- Teach patient to avoid food containing tyramine (dairy products, meat, fish, liver, some fruits (such as avocado, fig, and banana), chocolate, and yeast extracts. If patient ate these foods, the tyramine will break down in the GI tract (in the presence of MAO inhibitors) and release vaosopressers will lead to hypertensive crisis (severe elevation in blood pressure).
- Teach patient to avoid alcohol and other sleep inducing drugs.

Examples:
Phenelazine sulfate:
Trade name: Nardil.
Class.: MAO inhibitor, antidepressant.
Uses: Major depression e or without melancholia.
Dose: P.O. 15 mg tid.

2. Tricyclic antidepressants:
Clomipramine Hydrochloride:
Trade name: anafranil.
Class.: antidepressant, tricyclic.
Action: prevent the presynaptic re-uptake of the neurotransmitters (norepinephrine and serotonine) which will increase their concentration at the synaptic area alleviate depression.
Dose: P.O. 75-150 mg /day in 1-3 divided doses.
Uses: 
- Treatment of obsessive- compulsive neurosis.
- Panic disorders
- Phobic disorders.
Contraindications: pregnancy, lactation, shock, bone marrow depression.
Side effects: 
Hyperthermia, seizures, anemia, muscle weakness, drowsiness, ataxia, blurring of vision orthoslatic hypotension, dry mouth, constipation.
Nursing considerations:
- Monitor vital signs before & during therapy.
- Take with foods to decrease GI upset.

Imipramine Hydrochloride:
Trade name: Tofranil.
Class.: antidepressant, tricyclic.
Action: as anafranil.
Uses: 
- Relief symptoms of depression.
- Enuressis in children.
Dose: 
- For treatment of depression P.O: 50 mg bid or tid.
- For treatment of children enureses (6 years or older): 25 mg/day 1 hr before bedtime.

*Antiparkinson Agents*

Parkinson’s disease is a progressive disorder of the nervous system, affecting mostly people over the age of 50 years.

Signs & symptoms:
- Slowness of motor movements (bradykinesia, akinesia).
- Stiffness & resistance to passive movements “rigidity”.
- Muscle weakness.
- Tremors.
- Speech impairment
- Postural instability.

**Cause:** Unknown may be due to decrease in the neurotransmitter dopamine on the nervous system.

So that the administration of levodopa (the precursor of dopamine) will relieve the symptoms.

**Amantadine Hydrochloride:**

**Trade name:** Symmetrel.

**Class:** Antivirus drug, antiparkinson agent.

**Action:**
- Prevent the penetration of virus into cell by inhibiting uncoating of the RNA virus.
- Relief symptoms of parkinsonism by potentiating the release of dopamine within the CNS.

**Uses:**
- Influenza.
- Symptomatic treatment of parkinsonism (idiopathic)

**Contraindications:**
- Hypersensitivity.
- Pregnancy, lactation.

**Dose:** For parkinsonism 100 mg bid.

**Side effects:**
- Nausea, vomiting, anorexia, constipation.
- Depression, convulsion, hallucinations, ataxia.
- Dizziness, orthostatic hypotension.

**Nursing considerations:**
- Note any history of seizures.
- Don’t drive a car or work in a situation where alertness is important.
- Rise slowly from a prone position (to avoid orthostatic hypotension).
- Lie down if feeling dizzy.
- Monitor vital signs before & during therapy.

**Levodopa:**

**Trade name:** L-Dopa.

**Class:** Antiparkinson agent.

**Action:** It is a dopamine precursor, able to cross blood-brain barrier to enter the CNS. It is decarboxylated to dopamine in the basal ganglia replenishing depleted dopamine stores relief sings and symptoms of parkinsonism.

**Uses:**
- Idiopathic, arteriosclesotic & postencephalitic Parkinsonism
- Parkinsonism due to copper poisoning.

**Contraindications:**
- History of melanoma or undiagnosed skins lesion.
- Lactation.
- Hypersensitivity.
- Glaucoma
- Hypertension
- Use of monoamine oxidase (MAO) inhibitors.

**Side effects:**
- CNS effect: ataxia, hand tremors, headache and dizziness.
- Depression
- Paranoid ideation  - insomnia
- Dementia  - nightmares

**Dose:** 250 mg bid-aid with food.

**Nursing considerations:**
- Crushing tablets for patients with difficulty in swallowing.
- Review medical history for drug contraindications.
- Monitor vital signs frequently.
- Observe for signs of depression.
- Offer emotional support during therapy.
- Take levodupa with food.
- Not to take vitamin B6 because it reverse the antiparkinson action of levodupa.

**Trihexyphenidyl Hydrochloride:**
**Trade name:** Artane
**Class.:** Antiparkinson, anticholenergic.
**Action:** anticholinergic, relieves rigidity, has little effect on tremor, antispasmoic on smooth muscle.
**Uses:** for all types of parkinsouisun.

**Maintenance dose:** 5-10 mg 1-2 times daily.

**Side effects:** CNS stimulation (insomnia, agitation, restlessness) dry mouth, constipation, dizziness urinary retention.

*Centrally acting skeletal muscle relaxants*

**Diazepam:** valium.
studied before

**Anticonvulsants**

1. **Phenytoin:** Dilantin
   Studied before see antiarrhythmic.

2. **Ethosuximide:**
   **Trade name:** Zarontin
   **Class.:** anticonvulsant, succinimide type.
   **Action:**
   - The succinimide derivative, suppress the abnormal brain wave patterns associated with lapses of consciousness in absence seizures.
   - Depress motor cortex & raise the threshold of the CNS to convulsive stimuli.
   **Uses:** Primarily, petit mal seizure.
   **Side effect:** nausea, vomiting, anorexia, dizziness, drowsiness, fatigue, lethargy.
   **Contraindication:** Hypersensitivity.
   **Dose:** P.O. 500 mg/day on divided doses

**Nursing consideration:**
1- Report any increase in frequency of tonic-clonic (grand mal) seizures.
2- Monitor vital signs frequently.
3- Take drug with food to minimize GI upset.
4- Frequent assessment of drug level.
5- Monitor presence of skin rash, fever, joint pain, unusual bleeding, dark urine.

3. Acetazolamide:
Trade name: Diamox.
Class: anticonvulsant, diuretic.
Action: it is a sulfonamide derivative, act as an anticonvulsant by inhibition of carbonic anhydrase in the CNS ➺ CO2 tension ➺ neuronal conduction.
- As a diuretic: it inhibits carbonic anhydrase in the kidneys ➺ formation of bicarbonate & H ion from Co2 ➺ availability of active transport.
N.B.: Has a limited use as a diuretic because it increases the incidence of metabolic acidosis.
Uses: - Absence of seizure (petit mal).
- Grand-mal (tonic-clonic) seizure.
- Glaucoma.
Contraindications:
- Low serum level of sodium & potassium.
- Renal & hepatic dysfunction.
- Adrenal insufficiency.
- Hypersensitivity to thiazide diuretics.
Side effects: anorexia, polyuria, drowsiness, confusion, & acidosis.
Dose: Tab. 4-30 mg/kg/day in divided doses.

4. Carbamazepine:
Trade name: tegretol
Class: anticonvulsant.
Action: - semilar to cyclic antidepressant.
- antimanic , antidiuretic, anticholinergic & antipsychotic effects.
- Anticonvulvulant action unknown.
Uses: Epilepsy - tonic-clonic seizures - alcohol-withdrawal
- resistant schizophrenia. - trigeminal neuralgia.
Dose:
P.O. 200 mg bid.
Trigeminal neuralgia : 100-200 mg bid.
Side-effects:
Photosensifivily - Drowsiness, dizziness, unsteadiness.
Aplastic anemia -nausea, vomiting, blurring of vision.
Contraindications:
- Bone marrow depression.
- Hypersensitivity
- Lactation
- Patients taking MAO inhibitors.
Nursing considerations:
- Should be taken with food.
- Obtain baseline liver & kidney function.
- Protect tablet from moisture.
- Obtain baseline eye examination.
- Blood cells evaluation weekly.
- Monitor intake & output.
- Use safety measures.
- Advise client to avoid sunlight. (photosensitivity)

5. **Diazepam: studied before.**

6. **Magnesium sulfate**  
   **Class:** Anticonvulsant, electrolyte, saline laxative.  
   **Action:**  
   - It is an important cation present in the extracellular fluid.
   - It is an essential electrolyte for muscle contraction, certain enzyme system & never transmissions.
   - Magnesium depresses CNS & control convulsion by blocking the release of acetylcholine at the myoneural junction.
   **Uses:**  
   - Seizures associated with toxemia of pregnancy.
   - Epilepsy
   - laxative
   - Hypomagnesemia
   - In total parenteral nutrition
   **Contraindications:**  
   - In the presence of heart block.
   - In the presence of myocardial damage.
   **Side effects:**
   Magnesium intoxication — depression, flushing, hypotension, respiratory paralysis, muscle paralysis, respiratory failure.
   **N.B.** : Suppression of knee-Jerk reflex can be used to determine toxicity.
   Respiratory failure may result if drug is given after disappearance of this reflex.
   **Treatment of Magnesium intoxication:**
   1- Use artificial ventilation immediately.
   2- Have calcium glutinate readily available for I.V. use.
   **Dose:** anticonvulsant I.M. 1-5 g of 25% - 50% solution.  
   I.V. 1- 4 g of 10% - 20% solution.
   **Nursing considerations:**
   - For I.V. administer only 1.5 ml of 10% solution\minute.
   - For I.M., inject the drug deep into the muscle using 50% solution.
   - As a laxative, dissolve in a glass of ice water or other fluid to lessen disagreeable taste.
   - Obtain baseline Mg level.
   - Obtain history of kidney disease.
   - Check with the physician before administering magnesium if any of the following conditions exist:
   1- Absent patellar or knee jerk reflex.
   2- R.R. less than 16\m
   3- Urinary output less than 100 ml/4 hrs.
   4- Patient has a history of heart block or myocardial damage.
   - Have available I.V. calcium gluconate.
   - Don’t administer drug 2 hrs preceding delivery of the baby.
- If mother has received I.V. therapy of this drug 24 hours prior to delivery, assess the newborn for neurologic & respiratory depression.

7. **Paraldehyde: studied before.**

8. **Valproic acid:**
   - **Trade name:** Depakene.
   - **Class.:** anticonvulsant
   - **Action:** unknown
   - **Uses:** Epilepsy.
   - **Side effects:**
     Nausea, vomiting, sedation, depression bone marrow depression, skin rashes, transient alopecia, hepatotoxicity.
   - **Dose:** Initial 5-10 mg\(\text{kg/\text{day}}\), increase at one week.
     Interval 5-10 mg\(\text{kg/\text{day}}\) increased up to 60mg\(\text{kg/\text{day}}\).

*Narcotic Analgesics & Antagonists*

**Narcotic Analgesics:**
- It include opium such as morphine, codeine & opium derivatives such as Meperidine.
- These substances have similar pharmacological properties.
- Meperidine (Demerol) is the best known.
- The relative activity of all narcotic analgesics in measured against morphine.

**Dependence & Tolerance:**
- Remember that all drugs of this group may lead to addiction.
- Psychological & physical dependence & tolerance develop even when using clinical doses.
- Tolerance usually develops because the patient requires shorter periods of time between doses or larger doses for relief of pain.

**Effects of narcotic analgesics:**
1- On CNS:
   - Alteration of pain perception (analgesia) - Euphoria - Mental clouding - Drowsiness - Change in mood
   - Depress respiration: over dose leads to respiratory arrestdeath.
   - Depress cough reflex: codeine in small doses is used as antitussive.
   - Nauseant & emetic effect (stimulate the chemoreceptor trigger zone).
   - Morphine\(\rightarrow\) vasodilation\(\rightarrow\) hypotension.
   - Pupillary constriction (the most obvious sign of dependence).
   - Decreases the peristaltic motility constipation (some types used in diarrhea).

**Acute toxicity:**
Characterized by respiratory depression, deep sleep, stupor, coma, pinpoint pupil, R.R 2-4\text{\text{\text{\text{m}}}}, cyanosis, hypotension, decreased urinary out put, decreased temperature, clammy skin, and finally Death (due to Respiratory failure).

**Treatment of acute overdose:**
1- Induce vomiting or gastric lavage.
2- Artificial respiration.
3- Give narcotic antagonist (Narcan).
N.B.: 
Respiratory stimulants (caffeine) should not be used to treat depression from overdose of narcotics.

**Chronic toxicity:**
- The problem of chronic dependence on narcotics is well known & is not only the problem of the street but is also found often among those who have easy access to narcotics “physicians, nurses... Pharmacists”. Narcotic analgesics sometimes used for nontherapeutic purposes.
- Signs & symptoms:
  - Constricted pupil, constipation, skin infections, needle scare abscesses & itching on the anterior surface of the body.
  - Withdrawal signs appear when drugs is withheld for 4-12 hrs. & characterized by intense craving for the drug, insomnia, yawning, sneezing, vomiting, diarrhea, tremors, sweating, mental depression, muscular aches, pain, chills & anxiety. (they are rarely life-threatening).

**Action of narcotic analgesics:**
- Narcotic analgesics attach to specific receptor in the CNS resulting in analgesia-action
  - Action exactly is unknown but may be by decreasing cell membrane permeability to sodium transmission of pain impulses.

**Uses:**
- Severe pain
- Hepatic & renal colic.
- Preanesthetic medication
- Postsurgical pain.
- Diarrhea & dysentery
- Pain from MI, carcinoma.
- Postpartum pain & burns.
- Antitussive.

**Contraindications:**
- Asthmatic conditions
- Emphysema
- Severe obesity
- Convulsions
- Diabetic acidosis
- Myxedema
- Addison's disease
- Hepatic cirrhosis
- Children less than age of 6 months.

**Side effects:**
Respiratory depression, apnea, dizziness, euphoria headache, mental clouding, insomnia, nausea, vomiting, constipation, dry mouth, skin rashes, laryngospasm, urinary retention, and decreased libido.

**Nursing considerations:**
- Use supportive nursing measures as relaxation techniques to relieve pain before using narcotics.
- Explore the source of pain, use non-narcotic analgesia if possible.
- Administer the medication when needed, prolonging the medication administration will decrease the effect of the medication.
- Monitor vital signs & mental status.
- Monitor Respiratory rate (drug may lead to respiratory depression).
- Monitor blood pressure (hypotension may occur)
- Monitor pulse rare (if 60/min withhold the drug).
- Watch for constricted pupils. Document it and notify the physician.
- Monitor bowel function, since drug may cause constipation.
- Encourage client to empty bladder every 3-4 hrs (since drug may cause urinary retention).
- If client is bed ridden, use side rails.
- Inform the client's family that the drug may become habit forming and leading to addiction.
- Document any history of asthma or other contraindications.
- Have emergency equipment and narcotic antagonist available.

1. **Condeine sulfate**
   **Class**: Narcotic analgesic, morphine type.
   **Action**: - Resembles morphine pharmacologically but produce less effect on respiratory system, less nausea & less vomiting.
   - In high doses (more than 60 mg), it will irritate the cough center, but in lower doses, it is a potent antitussive and is an ingredient in many cough syrups.
   **Uses**: - Relief of mild to moderate pain.
   - Antitussive.
   **Dose**: - Analgesic: 15-60 mg q 4-6 hrs.
   - Antitussive: 10-20 mg q 4-6 hrs.

2. **Meperidine Hydrochloride “Pethidine Hydrochloride”**: 
   **Trade name**: Demerol
   **Class**: Narcotic analgesic, synthetic.
   **Action**: Similar to opiates.
   - It has no antitussive effect.
   - The duration of action is less than that of opium.
   **Uses**: - Severe pain.
   - Renal & hepatic colic.
   - Obstetric preanesthetic medication.
   - In minor surgeries.
   - Spasm of GI tract, uterus.
   - Prior some diagnostic procedures e.g. cystoscope.
   - Post operative pain.
   **Add. Contraindications**: - Hypersensitivity.
   - Convulsive states.
   - Children less than 6 months.
   - Head injuries.
   - Diabetic acidosis.
   **Add. Side effects**: Transient hallucinations, hypotension.
   **Dose**: Drug can is available in the form of tablets, syrup, I.M, S.C.
   Dose is 50-100 mg q 3-4 hr.
It can be given as I.V. continuous infusion on a concentration of 1 mg/ml.
It also can be given IV slowly, and should be diluted in a concentration of 10 mg/ml.

3. Methadone Hydrochloride:
Class: Narcotic analgesic, morphine type.
Action:
- Produce only mild euphoria, which is the reason it is used as a heroin withdrawal substitute & for maintenance program.
- It produces physical dependence but the abstinence syndrome develops more slowly upon termination of the therapy.
- Withdrawal symptoms are less intense but more prolonged than those associated with morphine.
- It is not effective for preoperative or obstetric anesthesia.
- It doesn’t produce sedation or narcosis.
Uses:
1- Sever pain.
2- Drug withdrawal.
Additional Contraindications:
- Pregnancy since it depresses respiration of neonate.
- I.V. use.
- Liver disease.
Additional side-effects:
Constipation, and pulmonary edema.
Dose:
Can be given oral, I.M., S.C. at a dose of 2.5 – 10 mg Q 3-4 hrs.

4. Morphine Sulfate:
Class: Narcotic analgesic, morphine type.
Action: See narcotic analgesic.
Uses:
- Intrathecally, epidurally, orally or I.V. infusion for acute or chronic pain.
- Preoperative medication.
- To facilitate induction of anesthesia or to decrease the dose of anesthesia.
N.B.: It is given in lower doses for continuous pain & in higher doses in sharp intermittent & all kinds of pain.
Additional contraindications:
- It is given epidural or intrathecal, if infection is present at injection site.
- In patients on anticoagulant therapy.
- Bleeding disorders.
- If patients have received parenteral corticosteroids within the past 2 weeks.
Dose:
- Oral: 10-30 mg Q 4 hr.
- I.M.: 5-20 mg/70 kg Q 4 hr as needed.
- I.V.: bolus of 2.5-15 mg for a person of average weight of 70 kg over 4-5 minutes (slowly).
- Continuous infusion: 0.1-1 mg/ml in 5% dextrose in water by a controlled infusion pump.

5. Percodan:
   Class. and content:
   - Percodan consists of 2 drugs.
   1. A non-narcotic analgesic (aspirin 325 mg)
   2. A narcotic agonist (oxycodone Hcl 4.5 mg & oxycodone terephthelate 0.38 mg.
   Action:
   Oxycodone acts at a specific opioid receptors in the CNS to produce analgesia, euphoria, and sedation. The receptors mediating these effects are thought to be the same as those mediating the effects of the endogenous opioids (enkephallins and endophines)
   Uses: Relief of moderate to severe pain.
   Dose: one tablet Q 6 hrs.

   Narcotic Antagonists:
   - The narcotic antagonists are able to prevent or reverse many of the pharmacological actions of morphine-type analgesics & meperedine as respiratory depression induced by these drugs within minutes.

Naloxone Hydrechtrolide:
   Trade name: Narcan.
   Class.: Narcotic antagonist.
   Action:
   - Block the action of narcotic analgesic by displacing previously given narcotics from their receptor sites or preventing them from attaching to opiate receptors.
   - The duration of action of naloxone is shorter than that of the narcotic analgesic so the respiratory depression may return when the narcotic antagonist has washed off the body.
   Uses:
   - Respiratory depression induced by narcotics.
   - Drug of choice when the depressant drug is unknown.
   - Diagnosis of acute opiate overdose.
   N.B. : Naloxine is not effective when respiratory depression is induced by hypnotic, sedative or other nonarcotic drugs.

Contraindications:
   - Sensitivity to drug.
   - Narcotic addicts since it will cause sever withdrawal symptoms.
   - Neonates.

Side effects:
   - Nausea, vomiting, sweating, hypertension, tremors.
   - If used postoperatively: tachycardia, pulmonary edema, hypo or hypertension.

Dose: 0.4-2 mg I.V. , S.C. or I.M.

Nursing considerations:
1- Determine the etiology of respiratory depression.
2- Assess & obtain baseline vital signs.
3- Monitor respiration closely after the duration of action.
4- Have emergency drugs & equipment available.
5- If the patient is comatose, turn him to his side to avoid aspiration.
6- Maintain safe environment (side rails & soft support).

Non-narcotic Analgesics & Antipyretics

- Drugs such as aspirin and acetaminophen are available without a prescription, thus consumed in large quantities for the relief of pain and fever.
- If they were used improperly, their administration may cause serious effects.
- They are responsible for accidental poisoning in small children.

Salicylates:

**Acetylsalicylic Acid:**
**Trade name:** Aspirin
**Classification:** Non-narcotic analgesic, antipyretic, anti-inflammatory, antirheumatic, antiplatelet, NSAID.
**Action:**
- The antipyretic effect is due to an action on the hypothalamus that results in heat loss by vasodilation of peripheral blood vessels & promoting sweating.
- The anti-inflammatory effects probably by decreasing prostaglandin synthesis & other mediators of the pain response.
- The analgesic action is not fully known but may be due to improvement of the inflammatory condition.

**N.B.:** Aspirin also produces inhibition of platelet aggregation.

**Uses:**
- Pain
- Arthralgia
- Dysmenorrhea
- Antipyretic (reduce fever)
- Anti-inflammatory (arthritis, gout, rheumatic fever)
- To reduce the risk of recurrent ischemic attacks & strokes in men.
- Reduction of risk of death or nofatal MI in patients with history of infarction or unstable angina pectoris.

**Dose:**
- In minor conditions: 325-600 mg Q 4 hours.
- May reach up to 6 grams /day in divided doses in arthritis and rheumatic conditions.

**Contraindications:**
- Hypersensitivity to salicylates.
- Asthma in conjunction with anticoagulant therapy.
- Vitamin deficiency (risk for bleeding increase with Vitamin K deficiency).
- Chickenpox or influenza (potential risk for Reye’s syndrome among children and teenagers).
- Pregnancy and lactation.
- One week before & after surgery.
- Patients receiving anticoagulants.
- Patients with bleeding disorders (ie, hemophilia)
- GI bleeding or hemorrhage from other sites.
- History of GI ulcers.

**Side effects:**
- Children e chicken pox (rays syndrom).
  - Heartburn, nausea, anorexia, occult blood loss..
  - GI bleeding, potentiation of peptic ulcer.
  - Bronchospasm.
  - Anaphylaxis
  - Skin rashes.
  - Increase bleeding time.

**Salicylate toxicity**
- **Salicylism**: nausea, vomiting, dizziness, tinnitus, difficulty hearing, diarrhea, mental confusion.
- **Acute aspirin poisoning**: Respiratory alkalosis, hyperpnea, tachpnea, hemorrhage, confusion, pulmonary edema, convulsion, tetany, metabolic acidosis.

**Drug interactions:**
- Risk for bleeding increase if taken with other anticoagulants.
- Risk of GI bleeding increase if taken with steroids, alcohol, or other NSAIINDs.
- Increased risk for salicylate toxicity if taken with frusimide (lasix)
- Hypotension may occur if taken with nitroglycerns.

**Nursing considerations:**
1. Take drug with or after food or with milk to decrease GI irritation.
2. Assess for history of asthma and history of hypersensitivity.
3. Do not use with other anticoagulants.
4- Note any history of peptic ulcer.
5. Report signs of side effect e.g. gastric irritation if occurs.
6- Aspirin is not given 1 week before & after surgery to prevent bleeding.
7- If patient is diabetic, discuss the possibility of hypoglycemia occurring-patients should monitor their blood glucose level frequently.
8- Teaches patient about the toxic symptoms (ringing in the ears dizziness, mental confusion-etc) and ask him/her to report it to physician.

**Acetaminophen: “paracetamol”**

**Trade names**: acamol, panadol
**Class.**: non-narcotic analgesic, para-aminophenol type.

**Action:**
- Acetaminophen decrease fever by an effect on hypothalamus leading to sweating & vasodilation.
- It also inhibits the effect of pyrogens on the heat-regulating center on the hypothalamus.
- It may cause analgesia by inhibiting CNS prostaglandin syntheses
So it has no anti-inflammatory effect.
- It doesn’t manifest any anticoagulant effect or any ulceration of GIT.

**Uses:**
- Pain due to Headache, dysmenorrhea, arthralgia, myalgia, musculoskeletal pain, immunization, teething, tonsillectomy.
- To reduce fever due to bacterial & viral infection.
- As a substitute for aspirin when contraindicated.

**Contraindications:** renal insufficiency, anemia.

**Side effects:**
- Chronic & even acute toxicity can occur after long symptom-free usage.
- Heamolytic anemia, neutropenia, thrombocytopenia
- Skin rashes, fever, jaundice, hypoglycemia.

**Symptoms of over dosage:**
Hepatic toxicity, general malaise, delirium, depression seizures, coma & death, nausea, vomiting, fever, and vascular collapse.

**Treatment of overdose:**
1. Induction of emesis.
2. Gastric lavage.
3. Activated charcoal.
4. Oral N-acetylcysteine (mucomyst) is said to reduce or prevent hepatic damage by inactivating acetaminophen metabolites which cause liver effects.

**Dose:** Tab. 500 mg Q 4 hrs or up to 1g Q 6 hrs.

**Nursing considerations:**
1. Suppositories should be stored below 27c.
2. Liver function studies for long term therapy.
4. Have mucomyst available for signs of toxicity.
5. Teach patient signs of toxicity to be reported immediately.

**Antirheumatic & Nonsteroidal Anti-inflammatory Agents**

**Action:**
As in aspirin, the therapeutic actions of these substances are believed to result from the inhibition of the enzyme cyclo-oxygenase which results in decreased prostaglandin synthesis so it is effective in:
- Reducing joint swelling, pain & morning stiffness.
- Increasing the mobility in arthritic patients.
- Antipyretic action due to decreased production of prostaglandin from the hypothalamus.
- Having irritating effect on the GIT.

**Uses:**
- Rheumatoid arthritis
- Osteoarthrosis.
- Gout
- Other musculoskeletal diseases.
- Dental pain
- Strains & sprains.

**Contraindications:**
1- Children less than 14 years of age.
2- Lactation.
3- Hypersensitivity (asthma, rashes, rhinitis).
   Uses with caution in patients with a history of GI disease & reduced renal functions.

**Side effects:**
- Peptic, duodenal ulcer, GI bleeding
- Nausea, vomiting, dyspepsia
- Dizziness, drowsiness
- Hypo + hyperglycemia
- Bronchospasm, rhinitis
- Blurring of vision
- Tinnitus, loss of hearing
- Bone marrow depression
- C.H.F.

**Nursing considerations:**
- Note any history of allergic responses to aspirin or nonsteroidal anti-inflammatory agents. {NS.AID.}
- Note the age of the client.
- Determine if patient is taking oral hypoglycemic or insulin and document it.
- Take these agents with milk or meal or antacids as prescribed.
- Encourage patient to take drug regularly.
- Report signs of GI irritation.
- Instruct client to report signs of bleeding, blurring of vision, tinnitus, rashes – etc.
- If the client has Diabetes Mellitus, explain the possible in increasing hypoglycemic effect of the drugs, to test urine & blood for glucose. To adjust dose of these agents.

1) **Diclofenac Sodium:**  
**Trade name:** Voltaren, Rufenal  
**Class:** Non steroidal anti-inflammatory analgesic.  
**Dose:** Suppositories, tabs or injection of 150-200 mg daily in 2-4 divided doses.  
**Nursing considerations:**
1. Give on full stomach to avoid GIT irritation.
2. When given IM, Give it deep into a large muscle because drug is very irritant.

2) **Indomethacin:**  
**Trade name:** Indocid.  
**Class:** Anti-inflammatory, analgesic, antipyretic.  
**Dose:** suppositories & caps.  
25mg – 50 mg bid-tid.

3) **Naproxen:**  
**Trade name:** Naprex.  
**Class:** Non-steroidal anti-inflammatory analgesic.  
**Dose:** 500 mg bid.
4) **Ibuprofen:**  
**Trade names:** Brufen, artofen.  
**Class:** nonsteroidal anti-inflammatory analgesic.  
**Dose:** 300 mg bid.

**Anti-gout Agents**

Gout: or gouty arthritis is characterized by an excess of uric acid in the body. This excess results from either over production of uric acid or from a defect in it’s breakdown or elimination.

When the concentration of sodium urate in the blood exceeds a certain level (6mg/100 ml), it may start to form a fine, needle-like crystals that can become deposited in the joints & cause an inflammatory response in the synovial membrane.

Hyperuricemia some-times accompanied with some conditions such as leukemia or lymphomas.

Treatment aims to reduce level of uric acid concentration in the blood.

**Allopurinol:**  
**Trade names:** Zyloric Acid, Zylol, zyloral.  
**Class:** Is a potent xanthine oxidase inhibitor which reduces both serum and urinary uric acid levels by inhibiting the formation of uric acid without disrupting the biosynthesis of vital purines.  
**Advantages:**  
1- Rapidly reduces uric acid bevels in urine & serum.  
2- Relieves joint pain, improves joint mobility & prevent the recurrence of acute attacks of gouty arthritis.  
3- Acts independently of renal functions, & is even effective in uremic patients.  
4- Minimize & prevents complications such as sever renal colic & progressive kidney disease.  
**Uses:**  
- Is the drug of choice for chronic gouty arthritis (not useful for treatment of acute gout).  
- Hyperuricemia associated with blood diseases, renal diseases.  
- Prophylaxis in hyperuricemia in patients with neoplastic conditions.  
- Treatment of patients with recurrent uric stone formation.  
**Contraindications:**  
- Hypersensitivity.  
- Lactation.  
- Hemochromatosis.  
- Children except for those with neoplastic diseases.  
**Side effects:**  
Skin rash, alopecia, fever leukopnea, arthralgia, nausea, vomiting.  
**Dosage:**  
Forms available: Tablets 100 mg, tablets 300 mg .  
Dose is 200-600 mg/day.  
**Nursing considerations:**
- Administer with food or immediately after meal to lessen gastric irritation.
- At least 10-12 eight-ounce glasses of fluid should be taken each day.
- Keep urine alkaline to prevent the formation of uric acid stones.
- Take complete drug history.
- Monitor the CBC, liver & renal function & serum uric acid on routine bases.
- If skin rash appear, report to physician.
- Avoid excessive intake of vitamin C which lead to the potential for the formation of kidney stones.
- Advice clients not to take iron salts with allopurinol since high iron concentration may occur in the liver.

Colchicine:
Class: Antigout agent.

Action:
An alkaloid, does not increase the excretion of uric acid but it is believed to decrease the crystal-induced inflammation by reducing lactic acid production by leukocytes (resulting in a decreased deposition of sodium urate).

Uses:
- Prophylaxis & treatment of acute attacks of gout.
- Diagnosis of gout.
- In the prophylactic treatment of familial Mediterranean Fever (FMF).

Side effects:
- It is a toxic agent ____________ nausea, vomiting, diarrhea, abdominal pain.
- In case the above mentioned signs appear, discontinue drug for 48 hrs.

Prolong administration may lead to:
- Bone marrow depression.
- Peripheral neuritis.
- Liver dysfunction.

Dose:
Present in the form of tablets of 0.5 mg/ tablet.
Dose: 0.5 – 1.2 mg  Q 1-2 hrs until pain is relieved.
I.V.: 2 mg (subsequently 0.5 mg  Q  6 hours until pain is relieved).

Nursing considerations:
- Store at a tight, light resistance container.
- I.V. only because it is very irritant if given IM. or S.C.
- Obtain baseline hepatic function.
- Report to physician if nausea, vomiting or diarrhea occur.
- If given I.V., have atropine readily available to counteract adverse reactions.
- Assess the client frequently for signs of hepatic dysfunction as jaundice.

Drugs Affecting the Autonomic Nervous system

Sympathomimetic (Adrenergic) Drugs
- The adrenergic drugs supplement, mimic & reinforce the message transmitted by the natural neurohormones norepinephrine & epinephrine.
- These hormones are responsible for transmitting nerve impulses of the sympathetic nervous system.
- The adrenergic drugs work in 2 ways:
1- By mimicking the action of epinephrine and epinephrine (directly).
2- By regulating the release of the natural neurohormones from their storage sites at the nerve terminals (indirectly acting).
- The myoneural junction is equipped with special receptors for the neurohormones.
- These receptors are classified into: alpha receptor and Beta (β) receptors according to whether they respond to epinephrine, norepinephrine & to certain blocking agents.
- Alpha receptors are blocked by phentolamine. Where beta-receptors are blocked by propranolol & similar agents.

- Both alpha and beta receptors have been divided into subtypes:

**Alpha receptors**

- Alpha 1 - adrenergic
  - Vasoconstriction (of skin blood vessels).
  - Decongestion
  - Dilatation of eye pupil
  - Contraction of urinary bladder sphincter

- Alpha 2 - adrenergic
  - Insulin secretion
  - Motility + secretion of GIT

**Beta receptors**

- Beta 1 - adrenergic
  - Myocardial contraction
  - Regulate heart rate
  - Improve impulse
  - Lypolysis
  - Gluconeogenesis

- Beta 2 - adrenergic
  - Skeletal & coronary vasodilation
  - Bronchial dilation
  - Renin secretion
  - Motility & secretion of GIT

**Effects of adrenergic drugs:**

1. **Heart:** increase Heart rate, increase force of contraction, increase cardiac output.
   **Uses:** cardiogenic shock, bradycardia, resuscitation, heart block.
2. **Blood vessels:** Systemic vasoconstriction → decrease blood supply to
abdominal viscera, cerebrum & skin.
- B.P. in Large vessels increased & regulated.

**Uses:** Hypotension, nasal decongestion, biliary colic, nose bleeds, migraine, headache, allergic reactions.

3. **GI + GU tracts:** decrease glandular secretions, constriction of sphincters, decrease
   muscle tone & motility of GIT & urinary bladder, increase muscle tone & motility of the ureters.

   **Uses:** Enuresis, dysmenorrhea, biliary colic.

4. **Lungs:** Relaxation of muscles of bronchial tree.

   **Uses:** Bronchial asthma, emphysema, chronic bronchitis.

5. **Eyes:** Dilate iris, increase ocular pressure, relaxes ciliary muscle.

6. **CNS:** Excitory action, Respiratory stimulation, wakefulness.

7. **Metabolism:** increase in glycogenesis (sugar metabolism).
   Increase in lypolysis (release of fatty acids).

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**Drugs**

1) **Albuterol: salbutoml**

   **Trade name:** ventolin

   **Class.:** sympathomimetic agent, bronchodialtor

   **Action:** stimulate $\beta_2$ receptors of the bronchi leading to bronchodilation.

   **Uses:**
   - Bronchial asthma.
   - Bronchospasm due to bronchitis or emphysema.
   - Parenteral for treatment of status asthmaticus.

   **Dosage:**
   Aerosol for inhalation: 0.18 – 0.2 mg (2 inhalations) Every 4 – 8 hours.
   Solution for inhalation: 1.25 mg in 2 – 5 ml.
   Oral syrup, tablets: 2 – 6 mg tid – qid.

   **Side effects:**
   - Tachycardia, arrhythmias, anginal pain.
   - Nausea, vomiting.
   - Dizziness, sweating, flushing.
   - Headache, weakness, vertigo, and insomnia.

   **Nursing considerations:**
   - Don’t exceed the recommended dose.
   - The contents of the container are under pressure, don’t store near heat or open flames.
   - When given by neubilization, use facemask or mouth-piece.
   - Compress O2 or air at 6 – 10 L\min for 5-15 minutes.
   - Observe client for evidence of allergic response.
   - NEVER give the solution prepared to be given as inhalation by the IV route. It may cause severe tachycardia.

2) **Dopamine Hydrochloride:**

   **Trade names:** Intropin, docard

   **Class.:** Direct & indirect acting adrenergic agent.

   **N.B.:** Available for hospital use only on 5 ml ampules containing 200 mg doparninc hydrochloride.
Action:
- It is the immediate precursor of epinephrine in the body.
- It produces direct stimulation of β1 receptors resulting in increasing myocardial contraction, cardiac output as well as increase renal blood flow & sodium excretion.
- It exerts little effect on diastolic B.P. & induce fewer arrhythmias that seen on other adrenergics.
- Alpha receptors, which are stimulated by higher doses of dopamine exerts vasodilation effects which can override the vasodilating effect.
- In higher doses it stimulates alpha receptors leading to peripheral vasoconstriction.

Indications:
- Cardiogenic shock specially in M.I. associated with sever C.H.F.
- Hypotension due to poor cardiac out put.
- Shock associated with septicemia, trauma, heart surgery, renal failure & C.H.F.
- Cardiomyopathy.
- In lower doses (1-5 Mcg/kg/min) used in renal failure.

Contraindications:
- Pheochromocytoma, uncorrected tachycardia, arrhythmias.
- Hypovolemia.
- Safety and efficacy is not established in children.

Side effects:
- GI: Nausea and vomiting.
- CV: Ectopic heart-beats, tachycardia or bradycardia, anginal pain, palpitation, hypotension or hypertension, dyspnea, wide QRS complex.
- Others: headache.

Dosage and administration:
N.B. : This is a potent drug. It must be diluted before administration to the patient.

Suggested dilution:
Transfer contents of one ampule (5ml containing 200 mg of dopamine) by aseptic technique to either 250 or 500 ml bottle of sterile I.V. solution (saline, dextrose 5% or reinger lactate). These dilutions will yield a final concentration for administration as follows.
- 250 ml dilution contains 800 mcg/ml of dopamine.
- 500 ml dilution contains 400 mcg/ml of dopamine.

N.B. :
1- Solution stable after dilution for 24 hours.
2- Don’t add dopamine to NaHCO3 or other alkaline I.V. solutions since the drug is inactivated in alkaline solution.

Rate of administration:
Through a suitable I.V. needle or a catheter & through an electronic infusion pump, rate is regulated according to required dose.

Dose:
Renal dose: 1-5 Mcg/kg/minute.
Cardiac dose: start initially of 5 Mcg/kg/min then increase by increments up to a rate of 20-50 Mcg/kg/min.

Nursing considerations:
- Administer only by IV INFUSION (Not IV bolus nor IM)
- Drug must be diluted before use.
- Administer drug through a central line or a big vein (vein in the anticupital fossa is preferred over those in the hand).
- Stop the drug by small increments.
- Solution is stable for 24 hrs, protect it from light.
- Monitor B.P. & ECG continuously during drug administration.
- Monitor intake & output.
- Monitor patient for occurrence of side effects.
- Check I.V. site for signs of extravasation.
- Drug should be administered through electronic infusion device.

3) Ephedrine sulfate:
Trade names: Numacin, efedron nasal “nasal decongestant”.
Class: Direct & indirect- acting adrenergic agent.
Action:
Release norepinephrine from storage sites, stimulate alpha, $\beta_1 + \beta_2$ receptors bronchodilation, nasal decongestant, strength of skeletal muscle so it may be used on myasthenia gravis.
Uses:
- Bronchial asthma
- Topically as a nasal decongestant.
- Myasthenia gravis.
Side effects:
Urinary retention, painful urination, dry mouth, drowsiness, blurring of vision.
Dose:
As a nasal decongestant 2-3 drops at each nostril every 4 hours.
N.B.: Not recommended for children under 6 years.
Not to be used for 3-4 consecutive days.

4) Epinephrine:
Trade name: Adrenaline
Class: Direct acting-adrenergic agent.
Action:
A natural hormone produced from adrenal medulla, induce marked stimulation of alpha, $\beta_1 + \beta_2$ receptors causing cardiac stimulation, bronchodilation & decongestion.
Uses:
1- Relief of respiratory distress due to bronchospasm.
2- Rapid relief of hypersensitivity reactions.
3- Cardiac arrest.
4- Open- angle glaucoma.
5- To prolong the action of anesthesia.
6- Topically to stop bleeding.
Contraindications:
- Narrow angle glaucoma.
- Shock
- Lactation.
- Tachycardia
- During labor (it may delay the 2nd 8 loge do labor).
Side effects:
Fatal ventricular fibrillation.
Cerebral hemorrhage urinary retention, headache, necroses at injection side, blurring of vision, photophobia.

**Dose:**
Available in ampules of 1ml containing 1 mg adrenaline
Can be given by I.M injection., I.V. & S.C.
0.2 – 0.5 mg, IM or S.C. + Q  20 min – 4 hr as needed.

**N.B.** : For cardiac resuscitation 0.5 mg diluted to 10 ml with normal saline may be administered I.V. or intracardiac to restore myocardial contractility.

**Nursing considerations:**
- Never administer 1 : 100 solution IV., use 1 : 1000 mg sol. For I.V. use.
- Use tuberculine (1cc) syringe to measure adrenaline.
- Administer adrenaline using piggyback set to adjust the rate of infusion.
- Administer infusion by electronic infusion device for safety & accuracy.
- Closely monitor patients receiving I.V. adrenaline infusion.
- Note the client for signs of shock “loss of consciousness, clammy, cold skin, cyanosis…. etc.).
- Briskly massage site of S.C. or I.M. injection to hasten the action of the drug.

*Adrenergic blocking (sympatholytic) Agents*

**Beta blockers:** were discussed before.

**Parasympathomimetic (cholinergic) Drugs**
- The neurohormone acetylcholine is necessary for nerve impulses transmission in the parasympathetic (cholinergic) portion of the autonomic nervous system.
- The receptors of parasympathetic nervous system are classified into muscarinic type and nicotonic type.
- Cholinergic drugs can be divided into 2 classes:
  1. Directly acting drugs that mimic the action of acetylcholine.
  2. Indirectly acting drugs that increase the concentration of acetylcholine, usually by inhibiting acetylcholinesterase.
- Cholinergic drugs have the following pharmacological effects on various structures:
  1. **GIT:** Enhance secretion by gastric & other glands & this may cause:
     - Belching, heartburn, nausea & vomiting.
     - Increase smooth muscle tone & stimulate bowel movement.
  2. **GU system:** Stimulation of ureter & relaxation of urinary bladder resulting in micturation.
  3. **Cardiac muscle:**
     - Slowing heart rate (Bradycardia).
     - Decrease atrial contractility, impulse formation & conductivity.
  4. **Blood vessels:** Vasodilation skin temperature & local flushing.
  5. **Respiration:** Mucus secretion, bronchial constriction wheezing, coughing, shocking (specially in asthmatic patients).
  6. **Eyes:** Pupillary constriction (miosis), intraocular pressure.
  7. **Skin:** Activation of sweat & salivary glands.
Drugs:
1. **Pyridostigmine Bromide:**
   **Trade name:** Mestinon.
   **Class:** Indirectly acting, cholinergic – acetylcholinesterase inhibitor.
   **Action:** By inhibiting the enzyme cholinesterase, that lead to increase the concentration of acetylcholine at the myoneural junction which facilitate the transmission of nerve impulse across the myoneural junction, that lead to increase muscle strength in myasthenia gravis.
   **N.B.**:
   - It has a slower onset, longer duration of action & fewer side effects than neostigmine.
   - Atropine may be given to control side effects.
   **Uses:**
   Myasthenia Gravis.
   **Contraindication:**
   - Hypersensitivity
   - Bradycardia
   - Hypotension
   - Asthma
   - Hyperthyroidism
   - GI obstruction peptic ulcer.
   **Side effects:**
   Skin rash, thrombophlebitis after I.V. use
   Nausea, vomiting, diarrhea.
   Bradycardia, Hypotension, headache, dizziness.
   Urinary frequency (Incontinence), bronchosporn.
   **Dose:** Tab. 600 mg daily.

2. **Neostigmine Bromide:**
   **Trade name:** Prostigmin.
   **Dose:** Tab. 150 mg daily.
   All information as pyridostigmine.

3. **Ophthalmic cholinergic (Miotic) Agents:**
   - Commonly used for the treatment of glaucoma.
   **Action:**
   These agents inhibit the enzyme cholinesterase which lead to accumulation of acetylcholine & stimulate the ciliary muscles & increases contraction of the iris sphincter muscle. This opens the angle of the eye & results in increased the outflow of aqueous humor & consequently in decreased of intraocular pressure.
   **Uses:**
   - Glaucoma.
   - Diagnosis & treatment of esotropia.
   - Antidote against harmful effects of atropine-like drugs in patients suffering from glaucoma.
   **Contraindications:**
   Hypertension, inflammatory eye diseases (critis)
   Asthma, History of retinal detachment, Bradycardia, peptic ulcer.
   **Side effects:**
   Pain in eye, blurring of vision, Headache.
   Failure to accommodate to darkness, retinal detachment.
   Diarrhea, hypotension, salivation, bronchial constriction.
Nursing considerations:
1- Have adrenaline & atropine available for emergency treatment.
2- Stress the importance of taking eye drops exactly as prescribed
3- Minimize side effects by taking medication at bed-time.
4- Advice client not to drive a car for 1-2 hrs after administering eye drops.
5- Notify the physician, if side effects occurred.
6- Cold compresses for painful eye spasms.
7- Frequent eye examinations.

1) Carbachol:
Trade name: Isopto carbachol.
Uses: glaucoma.
Dose: 1 gtt of the solution in the conjunctiva 1-2 times daily.

2) Physostigmine salicylate:
Trade name: Eserine salicylate.
Uses: glaucoma.
Dose: 1 gtt of the 0.25 or 0.5 % solution bie-tid.

3) Pilocarpine nitrate:
Uses: glaucoma.
Dose: 1 gtt of 1-4 % solution gid.

Cholinergic Blocking (Parasympatholytic) Drugs*

Action:
These agents prevent the neurotransmitter acetylcholine from combining with receptors on the muscarinic site & nicotonic site.
The main effects:
1- Reduce spasm of smooth muscle such as spasm of the urinary bladder or intestines.
2- To block vagal impulses to the heart which will increase heart rate & conductivity.
3- To suppress or decrease gastric secretions, perspiration, salivation and secretion of bronchial mucus.
4- To relax the sphincter muscles of the iris & cause pupillary dilation (mydriasis) & loss of accommodation for near vision.
5- Act on CNS producing such reactions as depression (scopolamine) or stimulation (toxic dose of atropine) to produce antiparkinsonism effect.

Contraindications:
Glaucoma, tachycardia, myocardial ischemia
Prostate hypertrophy, myasthenia gravis, paralytic ileus,
Mental impairment, lactation, hepatic disease.

Side effects:
Nausea, vomiting, dry mouth, constipation, heartburn, dizziness, drowsiness, headache, insomnia, blurring of vision, photophobia, flashing, euphoria, hallucination flushing of the skin.

1) Atropine sulfate:
**Class:** Cholinergic blocking agent.

**Action:**
It is a parasympatholytic agent which cause relaxation of smooth muscles & inhibition of secretary glands: “See parasympatholytic”.

**Uses:**
- Adjunct in peptic ulcer treatment.
- Irritable bowel syndrome.
- Treatment of spastic disorders of biliary tract.
- During anesthesia to control salivation & bronchial secretions.
- Parkinsonism.
- Anti-arrhythmic (prophylaxis).
- Prophylaxis and treatment of toxicity due to cholinesterase inhibitor including organophosphate pesticides.
- Ophthalmologic treatment of uveitis.

**Contraindications:** See parasympatholytics

**Side effects:** See parasympatholytics

**Dose:**
Tablets: 0.3 – 1.2 mg Q 4-6 hr
Available in 1ml-ampoule containing 1 mg atropine.”
IM, I.V. & S.C. 0.4 – 0.6 mg Q 4-6 hour for anticholinergic action.

**N.B.**:
For treatment of toxicity from cholinesterase inhibitors
“organophosphorus poisoning”, give 2-4 mg IV initially then 2 mg every 5-10 minutes until muscarinic symptoms disappear and signs of atropine toxicity begins to appear like dilation of pupils, flushing of face & tachycardia.

**Nursing considerations:**
- Check dosage & measure the drug exactly.
- Assess for history of asthma, glaucoma, ulcer .. etc.
- Determine the age of the client.
- Frequent mouth care.
- Assess client for change in pulse rate.
- In case of blurring of vision, assist on ambulating & give safety measures.

2) **Scopolamine Hydrobromide** :

**Trade name:** Hyoscine.

**Class:** cholinergic blocking agent.

**Action**:
It is a parasympatholytic agent, depress the cerebral cortex, especially the motor area, act as a powerful hypnotic.

**Uses:**
1- Motion sickness (prevention and control of nausea and vomiting).
2- Preanesthetic.
3- Antiarrhythmic.
4- Mydriatic and cycloplegic.
5- Adjunctive with other drugs to treat GIT ulcers.
6- With other narcotics to treat biliary colic.

**Contraindications:**
- Hypersensitivity.
- Glaucoma.
- Bronchial asthma
- Cardiac arrhythmias.
- Pregnancy - Lactation.

**Dose:**
Oral: 0.25 mg 1 hour before travel (for motion sickness).
Parenteral: 0.32-0.6 mg SC or IM.

**Side effects:**
Pupil dilation, photophobia, blurred vision, headache, drowsiness.
Dry mouth, constipation, nausea, vomiting.
tachycardia, arrhythmia
Suppression of lactation, flushing, nasal congestion.

**Nursing considerations:**
As atropine.

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**Drugs affecting the respiratory system**

1. **Antiasthmatic Drugs**
   - **Theophylline Derivatives:**
     **Action:**
     They belong to the xanthine family.
     They stimulate the CNS, relax the smooth muscles of the bronchi and pulmonary blood vessels which result in relieving bronchospasm.
     They also have a slight diuretic effect, stimulate gastric acid secretion & increase the force and rate of the heart.

     **Uses:**
     - Prophylaxis and treatment of bronchial asthma.
     - Reversible bronchospasm associated with C.O.P.D.

     **Contraindications:**
     - Hypersensitivity
     - Hypotension
     - Coronary artery disease (angina pectoris).

     **Side effects:**
     - Nausea, vomiting, epigastric pain.
     - Rectal irritation following use of suppositories.
     - Headache, dizziness, Hypotension, arrhythmias (tachycardia)

     **N.B.**:
     Aminophylline given by rapid I.V. may produce hypotension, flushing, precordial pain, Headache & dizziness.

     **Overdose:**
     Toxicity is usually associated with parenteral administration & oral administration especially in children.
     Early signs include anorexia, nausea, vomiting, restlessness & irritability.
     Later symptom include: agitation, manic behavior, frequent vomiting, extreme thirst & convulsions.

     **Formulation:**
     Theophylline derivatives are available as I.V. injections, modified release tablets, capsules, rapid release tablets, syrup, and suppositories.

     **Dose:** individualized.

     **Nursing considerations:**
     1- Dilute drugs & maintain proper infusion rate.
     2- Assess client for any history of hypersensitivity.
3- Obtain baseline blood pressure and pulse prior to starting therapy, monitor B.P. & pulse closely during therapy.
4- Observe closely for signs of toxicity.
5- To avoid epigastric pain (when administered orally) give the medication with meals.
6- Monitor for serum level of theophylline.
7- Instruct the client to increase intake of fluids to liquefy secretions.

Examples:

1- Aminophylline:
Class: Antiasthmatic, bronchodilator
“Theophylline + ethylenediamine”
Action: Relaxes smooth muscles of bronchi causing bronchodilation and increasing vital capacity of the lungs.
Additional use: neonatal apnea and bradycardia.
Forms: Ampule 250 mg/10 ml
   Tablets 100mg – 200mg.
   Pediatric suppositories: 100mg
   I.V. administration: 5mg/kg over a period of 10 - 20 minutes.
Dose:
   IV administration: 250 mg Q 6-8 hours.
   Rectal: 500 mg bid.

2- Theophylline:
Class: Antiasthmatic, bronchodilator.
Trade name: theotrard.
Forms: Capsules containing 50, 100, 200, 300 mg

2. Antitussives*

   v The cough is a useful protective reflex mechanism through which the body attempts to clear the respiratory tract of excess mucus or foreign particles. Coughing may accompany upper respiratory tract infections, it may also indicate an underlying organic disease whose cause should be ascertained.
   v There are 2 types of cough
      1. Productive (cough accompanied by expectoration of mucus & phlegm).
      2. Nonproductive (dry cough)
   v All important treatment of cough is also proper humidification and intake of fluid.
   v Codeine: See narcotic analgesics

3. Expectorants*

   v Theoretically, the expectorants liquefy mucus and facilitate it’s removal from the lungs through coughing. There is no scientific basis for this.

4. Combination drugs
   v Used for coughs, colds, and congestion.
Actifed:
Class.
\textbf{Contents}: Each capsule or tablet contains:
1- Antihistamine: Triprolidine Hcl 2.5mg.
2- Decongestant: Pseudephedrine 60 mg.

Each 5 ml of syrup contains \frac{1}{2} the amount of the above drugs.
\textbf{Uses}: Treatment of nasal congestion, runny nose, itching of nose, itchy or watery eyes due to the common cold, allergic rhinitis or other U.R.T. problems.
\textbf{Dose}: one tab./caps every 6 hours.

Phenergan with codeine syrup:
Class.
\textbf{Content}:
1- Antihistamine: Promethazine Hcl 6.25 mg / 5ml
2- Antitussive: codeine phosphate 10 mg / 5ml.
\textbf{Uses}: Relief of cough & upper respiratory tract (U.R.T.) problems associated with the common cold or with allergy.
\textbf{Dose}: 5ml Q 6 hr.

Solvex:
Class. : Expectorant
\textbf{Content} : Each tablet contains bromhexine Hcl 8mg.
Each ml of solution (20 drops) contains 2mg.
\textbf{Action}: It is a mucolytic, expectorant which stimulate the mucous glands to produce a secretion which is viscid & has a reduced content of acid glycoprotein fiber.
\textbf{Indications}:
A condition of U.R.T. & lower R.T. associated with the retention of viscid mucous secretions e.g. as in bronchitis & sinusitis.
\textbf{Contraindication}: Hypersensitivity.
\textbf{Side effects}: G.I. discomforts. The solution has a bitter taste.
\textbf{Dose}: 1-2 tablets 3-4 times daily.
4-8 ml of solution 3-4 times daily.

5. Mucolytic*

Acetylcystine:
\textbf{Trade name} : Mucomyst.
\textbf{Class}: Mucolytic
\textbf{Action}:
It reduces the viscosity of purulent and non purulent pulmonary secretion and facilitate its removal.
\textbf{Uses}:
1- Adjunct with the treatment of chronic. Bronchitis, emphysema, tuberculosis, pneumonia, bronchiactasis, and atelactasis.
2- Routine care of patients with tracheostomy.
3- Pulmonary complications of cystic fibrosis.
4- Antidote in acetaminophen poisoning to reduce hepatotoxicity.
\textbf{Contraindications}:
Hypersensitivity.
\textbf{Side effects}:
- Increases the incidence of bronchospasm in patients with bronchial asthma.
- Increase the amount of liquefied secretions (pulmonary). Which must be removed by suction if cough is inadequate.
- Bronchial & trachial irritation, tightness in chest.
- Nausea, vomiting, rhinorrhea, rash, and fever.

**Dose:**
Nebulization into face mask: 2-10 ml of 10% solution 3-4 times daily.
Acetaminophen overdose: P.O. 140 mg/kg then 70 mg/kg every 4 hr for a total of 17 doses.

**Nursing considerations:**
- The 10% solution may be used undiluted.
- Use water for injection or saline for dilution of 20% solution.
- Administer the medication via face mask or Oxygen tent by positive pressure breathing machine as indicated.
- Closed bottles of solution remain stable for 2 years at 20 c.
- Opened bottles are stored at 2-8 C for 96 hours, so record time and date of opening on the bottle.
- It is incompatible with antibiotics, must be used separately.
- Have suction machine available.
- If bronchospasm occurs, have a bronchodilator available.
- Position the client on a position that helps to facilitate the removal of secretions.
- Monitor vital signs.
- Wash the client’s face following nebulization, usually the face becomes sticky.

**Antihistamines “H1 Blockers”**

- Histamine is stored in almost every type of tissue in the body.
- Appropriate stimuli including: tissue injury, antigen-antibody (allergic) reactions, and extreme cold trigger the release of histamine from it’s storage sites into the vascular system where it induces the following responses:
  1. Dilation & increased permeability of the small arterioles & capillaries results in increasing permeability to fluid leading to hypotension & edema nasal congestion & laryngal edema “associated with allergies”.
  2. Contraction of some smooth muscles such as those of bronchioles leading to bronchoconstriction “the role of histamine plays in bronchial asthma” , & Uterine contraction.
  5. Pain & itching because it stimulates the sensory nerve endings.

**Action:** “of antihistamines”

The effect of histamines may be reversed either by drugs that block histamine receptors (antihistamine) or by drugs that have effects opposite to those of histamine e.g. epinephrine.

Antihistamines used for the treatment of allergic conditions are referred to as H1-receptor blockers while those used for treatment of GI disorders as peptic ulcer are referred as H2-receptor blockers.

They don’t prevent the release of histamine.
They prevent or reduce increased permeability → edema & itching, & bronchospasm.

H1-blockers manifest varying degrees of CNS depression, anti-cholinergic & antiemetic effect.

**Uses:**
- Treatment of seasonal allergic rhinitis, allergic conjunctivitis.
- Treatment of urticarial transfusion reactions.
- Treatment of topic dermatitis.
- Treatment of insect bites.
- Sneezing & rhinorrhea due to common cold.
- Prophylaxis & treatment of motion sickness “nausea & vomiting”.
- Night – time sleep aid.

**Contraindications:**
- Hypersensitivity.
- Pregnancy.
- Glaucoma
- Prostatic hypertrophy
- CNS depression (phenothiazine type).
- Bone marrow depression
- Comatose patients.

**Side effects:**
- Sedation - deep sleep - Dizziness - Headache - muscle weakness - disturbed coordination - epigastric distress - dry mouth - nausea - vomiting
- urinary frequency, anemia (pancytopnea).
- Paradoxical excitation (especially in children & elderly) → Restlessness, irritability, insomnia, hysteria, tremors euphoria, nervousness, hallucinations, disorientation & convulsion.
- Usually caused by overdose (acute toxicity).

**Treatment of overdose:**
- Symptomatic & supportive.
- Vomiting is induced with syrup of ipecac.
- Gastric lavage.
- Vasopressors (to treat hypotension) – e.g. Dopamine, adrenaline.
- Phenytoin for treatment of convulsion.

**N.B. :** Don’t use CNS depressants including diazepam.

**Nursing Considerations:**
- Inject I.M. preparations deep into muscles.
- Oral preparations may cause gastric irritation, so give drug with meals.
- Note if the client has any medical history of ulcer, glaucoma & if the client is pregnant.
- Obtain a baseline B.P., Pulse & respiration.
- Note signs of CNS depression (signs of overdose so induce vomiting).
- If in hospital, use side rails (safety measures).
- Advise client to report signs of side effects immediately.
- Instruct client to avoid undue exposure to sun.
- If the drug is being used for motion sickness, it should be taken 30 minutes before transporting.
- Caution the client not to drive a car or operate other machinery.
*Drugs in this group:*

1- **Astemizole:**  
**Trade name:** Hismanil  
**Class.**: antihistamine  
**Action:** It has no sedative, antiemetic or anticholnergic effects.

2- **Brompheniramine Maleate:**  
**Trade name:** ahiston.  
**Class.** : Antihistamine.  
**Action:** It has little sedative effect.  
**Dose:** each tablet contains 2 mg  
1-2 tablets  3-4 times daily.

3- **Chlorpheniramine maleate:**  
**Trade name:** Anaphyl  
**Class:** Antihistamine  
**Action:** sedation is less pronounced.  
**Dose:** syrup each 5ml contains 5mg  
2 teaspoonful 3-4 times daily.

4- **Promethazine Hcl:**  
**Trade name:** phenergan, prothiazone.  
**Class:** It is aphenothiazine derivative. It is a potent antihistamine with prolonged action. It may cause sever drowsiness. It also provides antiemetic effect (it chemo receptor trigger zone ).  
**Uses:**  
- Motion sickness.  
- Nausea & vomiting due to anesthesia.  
**Forms:**  
Syrup:  5ml contains 5 mg , 25 mg.  
Ampule:  50 mg \2ml.  
**Dose:**  
Antihistamine: 125 mg 4 times daily.  
Sedative:  25 mg – 50 mg.  
Antivertigo:  25 mg 2 times daily.

*Drugs affecting the G.I.T. *

1. **Antacids**  
**Action:**  
- Antacids act by neutralizing or reducing gastric acidity , thus increasing the pH of the stomach and relieving hyperacidity. If the pH is increased to 4 , the activity of pepsin is inhibited.  
- Ideally, antacids should not be absorbed systemically “NaHco3 & CaCo3 may produce systemic effects”.
Antacids containing magnesium have a laxative effect.
- Antacids containing aluminum or calcium have a constipating effect.

**Uses:**
- Treatment of hyperacidity. (Heart- burns).
- Peptic ulcer
- Duodenal ulcer.
- Gastroesophaged reflux.

**Contraindications:**
- Sodium containing products are contraindicated in C.H.F., hypertension, and other conditions requiring low sodium diet.
- Pregnancy
- Children less than 6 years of age.

N.B.: chronic use of aluminum containing antacids may contribute to development of Alzheimer’s disease.

**Nursing considerations:**
- It is recommended that most antacids be taken at 3 hours after meals & at bed – time.
- Tablets should be thoroughly chewed before swallowing & followed by a glass of milk or water.
- Shake liquid suspensions thoroughly before pouring the medication.
- Client’s taking aluminum or calcium containing antacids should take 2500-3000 cc of fluids to prevent constipation.
- Advise clients to report persistent diarrhea or constipation to physician.

**Drugs in this group:**

1. **Aluminum Hydroxide Gel:**
   - **Class:** Antacid
   - **Action:** has no systemic activity, has demulcent activity & is constipating. Al (OH)₃ & phosphorus form insoluble phosphates that are eliminated in feces prevent phosphates urinary stones.
   - **Additional uses:** prevention of urinary stones, hyperphosphatemia.
   - **Side-effects:** constipation, intestinal obstruction, bone pain, muscle weakness.
   - **Dose:** 500-1800 mg 3-6 times daily after meals, between meals & at bed time.

2. **Calcium carbonate:**
   - **Class:** antacid.
   - **Action:** Nonsystemic, since calcium carbonate is constipating it is often alternated or mixed with Mg++ salts.
   - **Additional uses:** calcium deficiency.
   - **Side effects:** constipation, flatulence, eructation, intestinal obstruction, metabolic alkalosis, hypercalcemia, rebound hyperacidity.
   - **Dose:** 0.5 – 1 g as necessary.

3. **Maalox:**
   - **Class / content:** Tablet: antacids Al(OH)₃ 200 mg + Mg (OH)₂ 200 mg.
     - Suspension: antacids 225 mg of Al(OH)₃/5ml + 200mg Of Mg(OH)₂.
   - **Additional uses:** hiatus hernia
Dose:
2-4 tabs - 20-60 m after meals & at bed time.
Suspension: 10-20 ml aid- 20-60 m after meals & at bed time.

4- Magnesium Hydroxide (magnesia):
Class: antacid, laxative
Action: Acts as an antacid by neutralizing HCl, it doesn’t produce alkalosis & has a demulcent effect.
As a laxative, it increases the bulk of the stools by attracting & holding large amounts of fluids. The increased bulk results in the mechanical stimulation of peristalsis.
Uses:
- antacid
- laxative to empty the bowel prior to diagnostic or surgical procedures.
Contraindications:
- poor renal function.
Side effects: Diarrhea, abdominal pain, nausea, vomiting, hypermagnesemia.

5- Sodium Bicarbonate: NaHco3
Class: Alkalinizing agent, antacid, electrolyte.
Action: Is due to neutralization of HCl by forming sodium chloride & CO2.
- NB:- Rarely used as antacid because of:
  1- It’s high sodium content.
  2- Short duration of action.
  3- Ability to cause alkalosis.
Uses:
- Hyperacidity - severe diarrhea (increased loss of Hco3 -)
- Metabolic acidoses (shock, dehydration, renal diseases.....)
Contraindications:
- C.H.F. - Renal impairment
- Edema - Cirrhosis of the liver
- Metabolic or respiratory alkalosis.
- Children less than 6 years of age.
Side effects:
Metabolic alkalosis (nausea, vomiting, cramps, dizziness, decreased breathing).
Extravasation following I.V. use may manifest: ulceration, sloughing, cellulitis or tissue necrosis.
Nursing considerations:
- I.V. dose should be determined by Arterial Blood Gases analysis.
- Should be administered slowly.
- Periodically assess patient serum pH during the therapy.
- Observer for signs of edema.
*Antiulcer Drugs*
1- Cimetidine:
Trade name: Tagamet
**Class:** Histamine H2-receptor blocking agent.

**Action:** decreases the acidity of the stomach by blocking the action of histamine which involved in triggering gastric acid secretion. It blocks the action of histamine by competitively occupying the histamine H2-receptors in the gastric mucosa leading to decrease secretion of HCl.

**Uses:**
- Short-term (up to 8 wks) & maintenance treatment of duodenal ulcer & treatment of benign gastric ulcer.
- Management of hypersecretion of gastric acid.
- Reflux esophagitis.

**Contraindications:**
- Children under 16 years.
- Lactation.
- Impaired renal & hepatic function.

**Side effects:**
Diarrhea, hepatic fibrosis, Hepatitis, Pancreatitis, Hallucinations, Dizziness, Headache, confusion, ataxia, double vision.
Hypotension, Arrhythmias following I.V. administration.
Aplastic anemia, thrombocytopenea.

**Dose:** 300 mg, 4 times daily with meals & at bedtime.

**Nursing considerations:**
- Administer oral medication with meals, if I.V. dilute as prescribed.
- Note the general condition of the patient (If take chemotherapy or radiation).
- Note signs of infection.
- For diarrhea, maintain adequate hydration.
- Monitor renal function.
- Be alert for mold swings that may occur.

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2- **Ranitidine Hcl:**

**Trade name:** Zantac, Randine “ampule 50 mg \2m.” Tab. 150, 300 mg.

**Class:** H2-receptor antagonists.

**Action:** It competitively inhibits gastric acid secretion by blocking the effect of histamine on histamine H2-receptors.

**Uses:** see cimetidine (The same).

**Contraindications:**
Liver cirrhosis, impaired renal & hepatic function.

**Side effects:**
Constipation, nausea, vomiting, diarrhea, headache.
Dizziness, malaise, vertigo, bradycardia or tachycardia.
Pancytopnea, rashes, bronchospasm, alopecia.

**Dose:** 150 mg 2 times daily.
- Maintenance 150 mg at bed-time.

**Nursing considerations:**
- Dilute for I.V. use (50 mg in 20 ml of 0.9% Nacl).
- Note any evidence of renal or liver disease.
- Observe baseline liver & kidney function.
- Note for signs of infection.
- Adequate hydration for problem of diarrhea.
*Laxatives*

1-Saline laxatives:
**Action:** It increases the bulk of the stools by attracting & holding large amounts of fluid. The increased bulk results in the mechanical stimulation of peristalsis.
**N.B.** : The saline cathartics should be administered with sufficient fluid so as not to cause dehydration.
**Onset:** 0.5 – 3 hrs.
It contains Mg++ salts so observe for signs of magnesium intoxication (drowsiness, dizziness, other signs of CNS depression).
**Uses:**
- To empty the bowel prior to diagnostic or surgical procedures.
- To eliminate parasites following anthelmintic therapy.
- To remove toxic substances following poisoning.

2-Mineral oil:
**Class:** Emollient laxative.
**Action:** This mixture of liquid hydrocarbons obtained from petroleum lubricates the intestines, it also decreases absorption of fecal water from the colon.
**Onset:** P.O. Q 6-8 hrs, enema 2-15 minutes.
**Uses:**
- Constipation:
- To avoid straining in certain conditions e.g. hemorrhoid & certain cardiovascular conditions.
- To soften feces during fecal impaction.
**Contraindications:** nausea, vomiting, abdominal pain, intestinal obstruction.
**Side effects:**
- Pneumonia due to aspiration of mineral oil.
- Pruritus.
- In pregnancy, it decreases vitamin K absorption leading to hypoprothrombinemia in the newborn.

3-Glycerin Suppositories:
**Class:** miscellaneous laxative.
**Action:** promote defecation by irritating the rectal mucosa as well as by hyperosmotic action. It also softens & lubricates fecal material.
**Onset** 15-60 minutes.
**Uses:**
- To evacuate the colon prior to rectal & bowel examination or surgery.
- To establish normal bowel function in patients dependent on laxatives.
**Contraindications:**
Anal fissure, fistula, ulcerative hemorrhoids.

*Digestants*
Pancreatin:
**Class:** Digestant.
**Action:** This mixture of enzymes (pancreatin, lipase, & amylase) is obtained from hog pancreas. The preparation increases digestion of food.
**Uses:** Pancreatic deficiency as pancreatitis, cystic fibrosis & pancreatectomy.
**Side effects:**
- Rash, sneezing, lacrimation (allergic).
- Holding tab. in mouth causes stomatitis & ulceration of the mouth.
- High doses may cause hyperuricemia.

Emetics / Antiemetics

**Emetics:** are used in cases of acute poisoning to induce vomiting when it is desirable to empty the stomach promptly & completely after ingestion of toxic materials. Vomiting can be elicited either by direct action on the chemoreceptor trigger zone in the medulla or by indirect stimulation of the GIT.

1- **Apomorphine Hcl:**
**Class:** Emetic.
**Action:** is a synthetic derivative of morphine which produce vomiting by stimulating the CTZ.
**Uses:** In drug overdose. - Poisoning.
**Contraindications:**
- Shock
- Drug induced CNS depression.
- Ingestion of corrosive substance as lye.
- Patients sensitive to morphine.
**Side effects:**
Depression, euphoria, tremors, tachypnea.
Overdose may lead to excessive emesis, cardiac depression and finally death.
**Dose:** 5-6 mg as a single dose.

**Nursing considerations:**
- Before administration, give client 300 ml of water.
- Store solution in dark closed container.
- Have a naloxone available “for respiratory distress”.
- Note any sensitivity to morphine.

2- **Ipecac syrup:**
**Class:** Emetic.
**Action:** An alkaloid extracted from Brazil root, acts both locally on the gastric mucosa & centrally on the CTZ.
**N.B.** : Ipecac syrup must not be confused with ipecac fluid extract which is 14 times as potent.
**Uses:** Drug overdose, poisoning to empty stomach.
**Contraindications:**
- With corrosives
- Unconscious patients.
- Shock.
- Children under 6 months.
**Dose:** 5-10 ml preceded or followed by 240 ml of water.
Antiemetcs:

Nausea & vomiting can be caused by a variety of conditions such as infections, drugs, motion, organic disease or psychological factors. The underlying cause of the symptoms must be elicited before emesis is corrected. The act of vomiting is complex. The vomiting center in the medulla responds to stimulation from many peripheral areas as well as stimuli from CNS itself, the CTZ in the medulla, the vestibular apparatus of the ear & the cerebral cortex.

The selection of antiemetic depends on the cause of the symptom as well as on the manner in which the vomiting is triggered.

Many drugs used for other conditions such as antihistamine, phenothiazines & barbiturates have antiemetic properties & can be so used.

Drug interaction:
Because of their antiemetic and antinauseant action the antiemetics may mask overdosage caused by other drugs.

Nursing considerations:
1- Take a complete history, if it is unusual occurrence or if it is a recurring phenomenon.
2- Assess for other untoward symptoms as increased intracranial pressure or intestinal obstruction (antiemetic may mask signs of underlying pathology).
3- Caution the client that drug tends to cause drowsiness & dizziness, advise him/her to avoid hazardous tasks.

Metoclopramide Hcl:
Trade name: Pramin
Class: Antiemetic
Action: It is dopamine receptor antagonist acts both centrally & peripherally, centrally due to the effect in the CTZ (inhibition), Peripherally it stimulate the motility of the upper GIT without affecting gastric & biliary or pancreatic secretions. It relaxes the pyloric sphincter & increases the peristalsis of the duodenum resulting in accelerated gastric emptying & intestinal transit.

Indications:
1- Digestive disorders leading to relief GIT pain, Dyspepsia & regurgitation in peptic ulcer, reflux esophagitis & postanasthetic vomiting.
2- Nausea & vomiting as in chemotherapy.
3- Facilitate diagnostic procedure e.g. barium meal.

Side effects:
GI disturbances, transient hypertension, supraventricular tachycardia, dizziness & extrapyramidal effect “convulsion”.

Forms:
Ampule  10 mg\2ml
Ampule  50 mg\10ml
Tablet 10mg
Syrup  5mg\5ml
Suppository. 20mg (adult), 5mg (children).

Dose:
-10 mg, 30 minutes before meal & at bed time.
-For chemotherapy 2 mg /kg, 30 minutes before chemotherapy.

Contraindications: Seizure (epilepsy), Pheochromocytoma, intestinal
Nursing considerations:
1- Don't give pramin to patients with epilepsy, pheochromocytomes or patients with intestinal obstruction.
2- Administer oral medication 30 minutes before meal & at bed time.
3- Administer I.V. injection slowly over 1-2 minutes.
4- Be aware of the extrapyramidal symptoms specially in children.

Other antiemetics:
Diphenidol Hcl “ventrol”.
Trimetho benzamide Hcl “Tigan”.

*Hormones & Hormone Antagonists*

Insulin:
2 main hormones are secreted from the pancreas:
1- Insulin which is secreted by β -cells of islets of langerhans & stored in the pancreas (β -cells ) as a large protein known as proinsulin.
2- Glucagon which is thought to oppose the action of insulin. It is secreted by the --- cells of islets of langerhans, it converts glycogen to glucose & elevates blood glucose level.

Diabetes mellitus is a disease in which the islets of langerhans in the pancreas produce either no insulin or insufficient quantities of insulin. It is classified as insulin dependent (type 1 or juvenile-onset) & noninsulin dependent (type II or maturity-onset).

It can be treated successfully by the administration of insulin isolated from the pancreas of cattle or hogs or of human insulin made either semisynthetically or derived from recombinant DNA technology.

The structure of insulin from pork - sources more closely resembles human insulin than that from beef sources.

Insulin:
1- Rapid-acting insulin.
   One) Insulin injection (regular, crystalline zinc insulin).
   Two) Prompt insulin zinc suspension.
2- Intermediate-acting insulin
   One) Isophane insulin suspension (NPH)
   Two) Insulin zinc suspension (lente)
3- Long-acting insulin
   Un) Protamine zinc insulin suspension (PZI)
   Deux) Extended insulin zinc suspension (ultralente)

N.B. : Insulin preparations with various times of onset & duration of action are often mixed to obtain optimum control in diabetic patients.

Action:
1- Facilitates the transport of glucose into cardiac & skeletal muscles & adipose tissue.
2- Increases synthesis of glycogen in the liver.
3- Stimulates protein synthesis & lipogenesis.
4- Inhibits lipolysis & release of free fatty acids from fat cells.
5- Causes intracellular shifts of potassium.
N.B. : Since insulin is a protein, it is destroyed in the GIT thus it must be administered parenterally.
- It is metabolized mainly in the liver.

Uses:
- Replacement therapy in type I diabetes.
- Indicated in type II diabetes when other measures have failed or with surgery, trauma, infection, fever, endocrine dysfunction, pregnancy, gangrene, kidneys or liver disease.
- Regular insulin is used in I.V. hyperalimentation.
- Regular insulin is used in I.V. dextrose to treat severe hyperkalemia.

Contraindications:
Hypersensitivity to insulin.

Side effects:
1- Hypoglycemia due to overdose, decreased food intake or hard exercise, “Hunger, weakness, fatigue, nervousness pallor or flushing, profuse sweating, headache, numbness of mouth, tingling in the fingers, blurred vision, hypothermia & loss of consciousness.
“Sever prolonged hypoglycemia may cause brain damage.”
2- Allergic urticaria, lymphaenopathy. “Use human Insulin product”.
3- In site of injection: developing of swelling, itching, atrophy or hypertrophy of S.C. fat tissue so rotate site of injection to minimize the problem.
4- Insulin resistance caused by obesity, infection, trauma, surgery etc.
5- Hyperglycemic rebound (somogyi effect) in patients who receive chronic overdose.

Diabetic coma is usually precipitated by the patient’s failure to take insulin.

*** Treatment of diabetic coma:
20 – 30 units of insulin, then 20 units every 30 minutes.
To avoid hypoglycemia give 1 g dextrose for each unit of insulin is administered with supplemental electrolytes (K+ ) & fluids.
Monitor vital signs.
Urine samples for analysis.

*** Treatment of hypoglycemia:
- Mild hypoglycemia: relieved by oral administration of CHO as orange juice.
- In comatosed patients: administer 10 –30 ml of 50% dextrose solution I.V.

Dose:
Usually administered S.C.

N.B. : Regular insulin is the ONLY preparation that may be administered. I.V.
This route should be used only for patients with severe ketoacidosis or diabetic coma.
- Always expressed in units.
- Dosage is individualized, it is established & monitored by blood glucose, urine glucose & acetone test.

Insulin antagonists:
1- Growth hormone elevates glucose level & decreases glycogen synthesis.
2- Glucocorticoids enhance conversion of protein to glucose.
3- Adrenaline decreases insulin release & enhance glycogenolysis.
4- Thyroid hormone promote gluconeogenesis.
5- Glucagon.

Nursing considerations:
1- Read the product information & any important notes inserted into the package.
2- Refrigerate stock supply of insulin but avoid freezing.
3- Follow the guidelines with respect to mixing the various types of insulin.
4- Invert the vial several times to mix before the material is withdrawn “avoid vigorous shaking”.
5- Assist patient for self-administration of insulin.
6- Rotate the sites of S.C. injections to prevent the problem of hypertrophy or atrophy at injection site.
7- Allow insulin to remain at room temperature 1 hour before administration.
8- Apply pressure for 1 minute, don’t massage since it may interfere with rate of absorption.
9- If breakfast must be delayed, delay the administration of morning dose of insulin.
10-Obtain a thorough nursing history from the client / family.
11-If the client has symptoms of hyperglycemia reaction:
   - Have regular insulin available for administration.
   - Monitor client closely after administration.
   - Check blood glucose, urine glucose, and acetone.
12-Check for early symptoms of hypoglycemia.
13-Assess diabetic more closely for infection or emotional disturbances that may increase insulin requirements.
14-Explain the necessity for close regular medical supervision.
15-Explain to patient how to test the urine for sugar & acetone.
16-Explain the use & care of equipment & the storage of medication.
17-Explain the importance of exercise & adhering to the prescribed diet.
18-Explain the importance of carrying candy or sugar at all times to counteract hypoglycemia should it occur.
19-Provide the client & family with a printed chart explaining symptoms of hypoglycemia, hyperglycemia & instructions concerning what to do for each.
20-Instruct client that blurring of vision will subside within 6-8 weeks.
21-Advise client to check vials of insulin carefully before each dose. Regular insulin should be clear, where as other forms may be cloudy.

1- Human Insulin:
Class: Human insulin from semisynthetic or recombinant DNA sources.
Action: Derived from recombinant DNA technology utilizes genetically modified E.Coli. These organisms synthesize each chain of insulin into the same aminoacid sequence as human insulin. The chains are then combined & purified to produce human insulin see information for insulin.
β See information for insulin
2- Insulin Injection (Regular, crystalline Zinc insulin)
Class: Rapid-acting insulin.
Kinetics:
- Onset ½ -1 hr (S.C) , 10-30m (I.V.).
- Peak 2-4 hr (S.C) , 15-30m (I.V.).
- Duration 5-7 hr (S.C) , 30-60m (I.V.).
Uses: suitable for treatment of diabetic coma, acidosis (diabetic) or other emergency situations.
Dose: individualized, initial 5-10 units 15-30 minutes before meals & at bedtime.
   Diabetic acidosis 0.1 unit / kg given by continuous I.V. infusion.

3- Isophane Insulin Injection (NPH):
N = neutral solution    P= stand of PZI
H= means that it is originated in Hagedron’s laboratory.
Class: Intermediate – acting insulin.
Kinetics: onset 3-4 hr, duration 18-28 hr.
   Peak 6-12 hr.
Dose: S.C. Individualized , initial 7-26 units as a single dose 30-60 minutes before breakfast.

4- Protamine Zinc Insulin (PZI):
Class: long –acting insulin
Kinetics: onset 4-6 hr, peak 14-24 hr, duration 36 hr.
Dose: see NPH.
See information for Insulin.

Oral Antidiabetic (Hypoglycemic) Agents
- Several oral antidiabetic agents are available for patients with noninsulin dependent diabetes.
- Oral hypoglycemic agents are classified as either first or second generation.
- Generation refers to structural changes in the basic molecule.
- Second–generation oral hypoglycemic agents are more lipophilic & have greater hypoglycemic potency (200 times) than first generation.

Classification:
1- First – generation sulfonylureas compounds such as:
   a) Tolbutamide (orinase).
   b) Chlorpromide (diabenase).
   c) Glibenclamide (Daonil).
2- Second-generation sulfonylureas compounds such as:
   -Glyburide (Micronase).
Action of oral antidiabetic agents:
1- Increases the sensitivity of pancreatic islet cells.
2- Increases insulin secretion by ... -cells.
3- The peripheral tissues become more sensitive to insulin due to an increase in the number of insulin receptors & increase the insulin ability to combine with receptors.
**Indication:**
Non-insulin dependent diabetes mellitus (NIDDM) (type II).
Patients should be subjected to a 7 day therapeutic trial.
Decrease in blood sugar, decrease in glucosuria & disappearance of polyuria, polydipsia, & polyphagia indicate that patient can be managed on oral antidiabetic agents.

**Contraindications:**
- Type I of D.M.
- Renal & liver disease.
- Diabetes complicated by recurrent episodes of ketoacidosis.

**Side effects:**
- Hypoglycemia (most common).
- Nausea, heartburn, diarrhea
- Headache, dizziness, general weakness.
- Pancytopnea.
- Chronic use increases risk of cardiovascular mortality.
- Cholestatic jaundice (rare).

**Nursing considerations:**
- See nursing considerations for insulin.
- Drugs may be taken with food to minimize GI upset.
- Stop the medication if signs of side-effects or ketoacidosis appear.

1- **Chlorpromide:**
**Trade name:** Diabenase.
**Class:** first generation sulfonylurea.
**Dose:**
- Initial 250 mg daily as a single or divided doses.
- Maintenance 100-250 mg daily as a single or divided doses.
**Doses:** More than 750 mg are not recommended.

2- **Glyburide:**
**Trade name:** Micronase.
**Class:** Second-generation sulfonylurea.
**Dose:**
- Initial 2.5-5 mg daily given with breakfast (or the first main meal) then increased by 2.5 mg weekly to achieve the desired response.

3- **Tolbutamide:**
**Trade name:** Orinase.
**Class:** First-generation sulfomylurea.
**Dose:**
- Initial 0.5 – 2 g daily, so adjust the dose depending on response (Maintenance 0.25 –3 g daily) (not exceed 3g).

4- **Glibenclamide:**
**Trade name:** daonil.
**Class:** First generation sulfonylurea.
**Dose:** ½ -1 tablet (5mg) daily, increased by 2.5 – 5 mg weekly to achieve the desired response.

**Insulin antagonist**
**Glucagon:**

**Class:** Insulin antagonist.

**Action:**

It is a hormone produced by the \( \alpha \) islets cells of pancreas. It increases blood glucose by:

1. Breakdown of glycogen to glucose.
2. Stimulate gluconeogenesis from aminoacids & fatty acids.
3. Inhibit conversion of glucose to glycogen.

Blood glucose within 5-20 minutes, Duration 1-2 hrs.

**Uses:** Hypoglycemic crisis (to terminate insulin induced shock in diabetic or psychiatric patients).

**N.B.** : The drug should only be used under medical supervision & according to instructions received from the physician.

- Failure to respond may be an indication for I.V. administration of glucose.

**Side effects:** Nausea, vomiting, respiratory distress, hypotension.

**Dose:** I.V., I.M. or S.C. 0.5-1 mg. (1-2 additional doses may be given at 20 minutes intervals if necessary).

**Nursing considerations:**

- Once the hypoglycemic client is respond, supplemental CHO should be given to prevent secondary hypoglycemia.
- Administer with glucose solution (dextrose) not saline (precipitate may from).
- Discuss with the client & family the need to keep the dose of insulin.
*Adrenocorticosteroids and analogs*

**Action:**
- They are a group of natural hormones produced by the adrenal cortex.
- They are used for a variety of therapeutic purposes.
- Many slightly modified synthetic variants are available today.
- Some patients respond better to one substance than to another.
- These hormones influence many metabolic pathways & all organ systems & are essential for survival.
- The release of corticosteroids is controlled by hormones such as corticotropin- releasing factor produced by the hypothalamus & ACTH produced by the anterior pituitary.

**Corticosteroids have the following effect:**

1. **CHO metabolism:**
   - Deposition of glucose as glycogen in the liver & conversion of glycogen to glucose when needed. (Glucogenesis).

2. **Protein metabolism:** The stimulation of protein loss from many organs.

3. **Fat metabolism:** The deposition of fatty tissue in facial, abdominal & shoulder regions.

4. **Water & electrolyte balance:** Alteration of glomerular filtration rate, increase sodium & fluid retention, also affect the excretion of potassium, calcium & phosphorus.

5. Have anti-inflammatory effect: they decrease prostaglandin synthesis.

6. The immunosuppressant effect: they decrease number of T-lymphocyte, monocytes, and eosinophils.

7. They aid the organism to cope with stressful situations e.g. trauma & severe illness.

According to their chemical structure, they fall into 2 classes.

1. **Glucocorticoids** e.g. cortisone & hydrocortisone: - regulate the metabolism of CHO, protein & fat.

2. **Mineralocorticoids** e.g. Aldosteron & desoxycorticosterone: - increase reabsorption of Na+ (+water) & excretion of potassium & hydrogen.

**Uses:**
- Therapy with glucocorticoids is not curative & many situations should be considered as adjunctive rather than primary therapy:
  1. Replacement therapy: adrenal insufficiency (Addison’s disease).
5- Respiratory diseases: bronchial asthma, rhinitis.
6- Ocular diseases: allergic & inflammatory conjunctivitis, keratitis . . .
7- Dermatological diseases: psoriasis, contact dermatitis, urticaria.
8- Diseases of the GIT: ulcerative colitis.
9- Nervous system: Myasthenia gravis.
11- Nephrotic syndrome.
12- Hematological diseases: hemolytic anemia, thrombocytopenic purpura.
13- Miscellaneous: septic shock, liver cirrhosis, stimulation of surfactant production, prevention of organ rejection.

Contraindications:
1- If infection is suspected (Mask signs & symptoms).
2- Peptic ulcer.
3- Acute glomerulonephritis.
4- Cushing’s syndrome.
5- Congestive heart failure.
6- Hypertension.
7- Hyperlipidemia.

Side effects:
Prolonged therapy may cause cushing-like syndrome & atrophy of the adrenal cortex & subsequent adrenocortical insufficiency.

N.B: steroid withdrawal syndrome may lead to: anorexia, nausea, vomiting, weight loss, headache, myalgia & hypotension.

Side effects include: Edema, alkalosis, hypokalemia, hypertension, CHF muscle wasting, weakness, osteoporosis, nausea & vomiting. Headache, hypercholesterolemia, hirsutism, amenorrhea, depression.

Dose: Highly individualized according to the condition & response of the patient.

N.B.: It is most important that therapy not be discontinued abruptly.

Nursing Considerations:
1- Administer oral forms with food to minimize ulcerogenic effect.
2- For chronic use, give the smallest dose possible.
3- Corticosteroids should be discontinued gradually if used chronically.
4- Document baseline weight, B.P., Pulse & temperature.
5- Frequently take BP, monitor body weight (signs of Na+ & H2O retention).
6- Periodic serum electrolytes, blood sugar monitoring.
7- Report signs & symptoms of side effects (cushing-like syndrome).
8- Discuss with female client potentials of menstrual difficulties.
9- Instruct the client to take diet high in protein & potassium.
10- Instruct the client to avoid falls & accidents (osteoporosis causes pathological fracture).
11- Remind the client to carry a card identifying the drug being used.
12- Stress the need for regular medical supervision.
13- Advise the client to delay any vaccination while taking these medications (weakened immunity).
14- Explain the need to maintain general hygiene & cleanliness to prevent infection.
1- Betamethasone:
Trade name: celestone.
Class: Adrenocorticosteroid, synthetic, glucocorticoid type.
Additional Uses: prevention of respiratory distress syndrome in premature infants

2- Dexamethasone:
Trade name: dexacort.
Class: adrenocorticosteroid – synthetic, glucocorticoid type.
Forms: Tablets 0.5 mg.
Ampule 4mg, 20 mg.

3- Hydrocortisone:
Trade name: solu –cortef, hydrocortone.
Class: adrenocorticosteroid, naturally occurring, glucocorticoid.
Forms: Vials 100 mg, 500 mg.

4- Prednisone:
Trade name: deltasone.
Class: adrenocorticosteroid, synthetic.
Forms: Tablets 5mg, 20mg.

5- Fludrocortisone acetate:
Trade name: florinef.
Class: adrenocorticosteroid, synthetic, mineralocorticoid.
Uses: Mainly used for treatment of addison’s disease.
Forms: 0.1 mg tablet.

4- Betamethasone ointment:
Trade name: Betacortin

*Posterior Pituitary Hormones*

1- Methylergonovine Maleate:
Trade name: Methergine.
Class: Oxytocic agent.
Action: Is a synthetic agent stimulates the rate, tone & amplitude of uterine contractions. It also stimulates smooth muscles surrounding certain blood vessels by interacting with adrenergic & dopaminergic receptors.

Uses:
1- Management & prevention of postpartum & postbortal hemorrhage by producing firm contraction & decrease uterine bleeding.
2- Incomplete abortion.
3- Migraine headache

Contraindications:
- Pregnancy - Hypertension
- To induce labor - Toxemia
- Prior to delivery of placenta

Side effects:
Nausea, vomiting, diarrhea, allergic reaction, Dizziness, headache, tinnitus.
N.B.: use of this substance during labor may result in uterine tetany with rupture, cervical laceration, embolism of amniotic fluid & intracranial hemorrhage in infant.

**Dose:**

**Forms:** Tablet 0.2 mg (0.2- 0.4 mg /6-12 hr for 48 hrs).

I.V. in emergency situations.

**2-Oxytocin:**

**Trade name:** Pitocin

**Class:** oxytocic agent.

**Action:**
- It has uterine stimulant, vasopressive & antidiuretic properties.
- Mimics uterine contractions of normal labor.
- Facilitates ejection of milk from the breasts by stimulating smooth muscles.

**Onset:** I.V. immediately, I.M 3-5 minutes.

**Peak** 40m,

**Duration** I.V. 20m. I.M. 30-60 m.

**Uses:**
- Antepartum induction or stimulation of labor.
- Uterine inertia (hypotonic contractions).
- For induction of labor in case of preeclampsia, eclampsia ,maternal diabetes & other conditions.
- To hasten uterine involution.
- Intranasally for postpartum hemorrhage & uterine atony.

**Contraindications:**
- Hypersensitivity - cephalopelvic disproportion (C.P.D.)
- Malpresentation - undilated cervix
- History of cesarean delivery.

**N.B.:** Oxytocin should never be given I.V. undiluted in high concentration.

**Side effects:**
Tetanic uterine contraction, rupture uterus Hypertension, tachycardia.

To Fetus: it may cause death, intracranial hemorrhage, brady or tachycardia.

**Dose:** I.M. or I.V. infusion for induction or stimulation of labor.

- I.V. infusion 10 units (1ml) diluted in 1000 ml of normal saline or 5% dextrose
- Initial 0.001 – 0.002 unit /minute, increased by small increments after 15 minutes intervals

**Nursing Considerations:**
1- The physician should be available during administration of the drug.
2- Use Y-tubing for I.V. administration (one bottle contain oxytocin & another free).
3- Note any history of hypersensitivity & other contraindications.
4- Check for cervical dilation & uterine contractions patterns.
5- Remain with the client throughout the administration of medication.
6- Monitor fetal heart rate at least every 10 minutes.
7- Check vital signs every 15 minutes.
8- Prevent uterine rupture & fetal damage by clamping off I.V. oxytocin, start medication – Free fluid, provide O2 & notify the physician in case of hypertonic uterine contraction & abnormal fetal heart rate patterns.
3- Vasopressin Tannate:

**Trade name:** Pitressin Tannate.

**Class:** Pituitary (antidiuretic hormone).

**Action:**
The ADH (vasopressin), released from the posterior pituitary regulates water conservation by promoting reabsorption of water by increasing the permeability of the collecting ducts of the kidney.

**Uses:** Neurogenic diabetes insipidus.

**Contraindications:**
- Angina pectoris
- Chronic nephritis
- To be given I.V.

**Side effects:**
Nausea, vomiting, increased intestinal activity leading to belching & increase desire to defecate, allergic reaction, tremor, bronchoconstriction.

**N.B.:**
- If used I.V. causes severe vasoconstriction & tissue necrosis.
- If used I.M causes pain & abscess formation at site of injection.

**Dose:** I.M. 1.5 – 5 units /1-3 days.

**Nursing considerations:**
1- Administer 1-2 glasses of water prior to use of medication to minimize side effects.
2- Warm the vial of vasopressin tannate in oil in hands & mix until the hormone is distributed throughout the solution before withdrawing the dose.
3- Note any history of vascular disease.
4- Monitor intake & output.
5- Check for signs of dehydration (thirst, skin turgor).
6- Weigh the pt daily.
*Calcitonin & Calcium salts*

Appropriate calcium levels in the body are required to maintain homeostasis for many processes including blood coagulation, regulation of heart rhythm & skeletal muscle contraction.

Maintenance of extracellular calcium levels is controlled by parathyroid hormone utilizing a feedback mechanism similar to that of other hormones. Dysfunction of the parathyroid may result in hypocalcemic tetany, seizures & death.

1) Calcitonin “Human or salmon”
   **Trade name:** calcimar
   **Classification:** calcium regulator.
   **Action:**
   Calcitonins are polypeptide hormones produced by the parafollicular cells of the thyroid gland in response to elevated serum Ca++ level. It antagonizes the action of PTH through independent mechanism:
   1- Reduce the rate of turnover of bone, to decrease resorption of calcium & may stimulate bone formation.
   2- Increase renal excretion of Na+, Ca++ & phosphate.
   **N.B.:** Calcitonin isolated from salmon (calcimar) has the same therapeutic effect as the human hormone except for a greater potency per milligram & somewhat longer duration of action.
   - Calcitonin-human is a synthetic substance that has the same sequence of amino-acids as the natural hormone.

**Uses**
1- For early treatment of hypercalcemia.
2- With calcium & vitamin D to treat postmenopausal osteoporosis.
3- Hyperparathyroidism.
4- Moderate to sever Paget’s disease.
5- Vitamin D intoxication.

**Contraindication:** Hypersensitivity.

**Side effects:**
Skin rash, nausea, vomiting, abdominal pain, diarrhea, inflammation at site of injection.
Headache, dizziness, eye pain and nasal congestion.

**Calcium Salts:**
**Classification:** Electrolyte, mineral
**Action:**
It is essential for maintenance of normal function of nerves, muscles, skeletal system & permeability of cell membranes & capillaries.
- Necessary for activation of many enzymes, contraction of cardiac, skeletal & smooth muscles, never impulses, respiration, and blood coagulation.
- Normal calcium serum concentration is 9-10.2 mg/dl.

**N.B.:** Hypocalcemia is characterized by muscular fibrillation, twitching, skeletal muscle spasm, leg cramps, tetanic spasms, cardiac arrhythmia, mental depression & anxiety.
- Excessive chronic hypocalcemia is characterized by brittle defective nails, poor dentation & brittle hair.
- Daily requirements for adult of calcium is 0.8 g /day.

**N.B.:** Hypocalcemia is well absorbed from the upper GIT, sever tetanic hypocalcemia is well treated by I.V calcium gluconate.

**Uses:**
**I.V.:**
1- Acute hypocalcemic tetany secondary to:
   * Renal failure
   * Hypoparathyroidism
   * Premature infants.
   2- To treat depletion of electrolytes.
   3- During cardiac resuscitation.

**I.M. or I.V:**
1- To reduce spasm (renal & intestinal).
2- To relief sensitivity reactions of insect bites.

**P.O:**
1- Chronic hypoparathyroidism.
2- Osteoporosis
3- Osteomalacia.
4- Rickets
5- Myasthenia gravis
6- Supplement for pregnant women.

**Contraindications:**
1- Digitized patients.
2- Some renal & cardiac patients.
3- Cancer with bone metastasis.

**Side effects:**
Hypercalceia: characterized by lassitude – fatigue, skeletal muscle weakness, confusion & constipation.
Renal calculi, bradycardia, arrhythmias & renal impairment.

**Following P.O:** constipation & gastrointestinal irritation may occur.

**Following I.V:** venous irritation, tingling sensation, feeling of heat chalky taste.

**N.B.:** Rapid I.V. administration. may result in vasodilation, decreased B.P. & H.R., cardiac arrhythmias, syncope and cardiac arrest.

**Following I.M:** Burning feeling, necrosis & cellulitis.

**Nursing considerations:**
A-Oral:
   - Administer 1-1.5 hr after meals, alkalis & large amounts of fat decrease the absorption of calcium.
- If the client has difficulty swallowing large tablets, obtain a calcium in water suspension by diluting the calcium in hot water then cooled by administration.

B-I.V:
- Administer slowly.
- Observe vital signs closely for evidence of bradycardia & hypotension.
- Prevent any leakage of medication into the tissue since it is extremely irritating.

C-I.M:
- Rotate the injection sites.
- Obtain baseline renal function.
- In case of hypocalcemic tetany, provide safety precautions to prevent injury.

Examples:
1- Calcium Carbonate
Trade name: Apocal
Class: calcium salt.
Dose: capsules, tablets, suspensions 1.25 – 1.5 g 1-3 times daily.

2- Calcium Gluconate
Class: calcium salt.

*Thyroid & Antithyroid Drugs*

The thyroid manufactures 2 active hormones, thyroxine and Triiodothyronine, both which contain iodine.

Diseases involving the thyroid fall into 2 groups:
1- Hypothyroidism: decreased thyroid hormones.
   - Cretinism in infancy & early life.
   - Myxedema in adult.
* Cretinism leads to decreasing in physical & mental development.
* Myxedema causes: dry swelling, edema (nonpitting)
  -- Primary results from atrophy of the thyroid &
  -- secondary as a result of hypofunction of pituitary gland or prolonged administration of antithyroid drugs.

2-Hyperthyrsidism:
- Increased production of thyroid hormones.
- Graves disease characterized by protruding eyes & extreme nervousness.

**Thyroid hormone preparations:**
- Levothyroxine sodium (T4) (synthroid)
- Liothyronine sodium (T3) (cytomel)
- Liotrix (Mixture of T4 + T3) (Euthroid, thyrolar).

**Action of thyroid hormones:**
1- Essential for normal physical & mental development of the fetus & infants.
2- Increase the BMR & blood sugar level, increase synthesis of fatty acids, and decrease plasma cholesterol & triglycerides.
3- Increase H.R. & peripheral resistance.
4- Decrease thyroid releasing hormone (TRH) & TSH from the hypothalamus & anterior pituitary.

Indications:
- Replacement therapy in primary & secondary myxedema, nontoxic goiter, and chronic thyroiditis.
- With antithyroid drugs for thyrotoxicosis to prevent hypothyroidism.
- Surgical removal of thyroid gland.

Contraindications:
- Uncorrected adrenal insufficiency.
- M.I.
- Hyperthyroidism.

N.B.:
- Should not be used to treat obesity or infertility in either males or females.
- In adrenal insufficiency corticosteroids should be initiated first before administration of thyroid preparations.

Side effects:
C.N.S.: Nervousness, headache, insomnia, tremor.
C.V.S.: Arrhythmias, palpitations, angina pectoris, dyspnea & hypertension.
GIT: Abdominal Cramps, appetite changes, nausea, vomiting, diarrhea & loss of weight.
Others: Menstrual irregularities, hyperthyroidism, sweating, allergic reaction, hyperglycemia.

Nursing considerations:
1- The treatment is initiated slowly (with small doses) & gradually increased.
2- Store medications in cool dark place.
3- Take complete nursing history.
4- Note if the client is taking antidiabetic drugs & document.
5- Take baseline ECG then at regular intervals.
6- Monitor thyroid function closely.
7- Observe client for side effects.
8- Monitor PT & PTT closely since the drug increases hypoprothrombinemia.
9- Monitor HR & B.P. closely for cardiac patients.
10- Instruct the client to report side effects e.g. weight loss & nervousness to physician.
11- Have dietitian counsel clients regarding diet according to the energy demands.
12- Female client should record menstrual irregularities.
13- Encourage the client to keep follow-up visits.

*Antithyroid Drugs*
Anti-thyroid drugs include thiouracil derivatives & large doses of iodide.

**Action:**
Inhibit partially or completely the production of thyroid hormones by the thyroid gland.

**N.B.:**
Since these agents don’t affect release or activity of performed hormone, it may take several weeks for the therapeutic effect to become established.

**Uses:**
- Hyperthyroidism
- In preparing the patient who must undergo surgery or radioactive iodine therapy.

**Contraindications:** Lactation.

**Side effects:**
- Loss of taste, enlargement of salivary glands.
- Thrombocytopenia, Leukopenia, Agranulocytosis.
- Skin rash & hypoprothrombinemia.

**Examples:**
1- Methimazole (Tapazole) is 10 times stronger than (PTU).
2- Propylthiouracil (PTU).

**Radioactive Agents:**
Sodium Iodide I 131

**Trade name:** Idotope.

**Class:** Radioactive agent.

**Action:**
It is distributed throughout the extracellular fluids following oral ingestion, it concentrates in the thyroid gland where it selectively damage or destroy the thyroid tissue.

**Indications:**
- Hyperthyroidism.
- Thyroid cancer.

**Contraindications:**
- Patient with vomiting & diarrhea.
- Lactation.
- Patients under 30 years of age.

**Side-effects:** specially when used for thyroid carcinoma.
Bone marrow depression: anemia, leukopenia, thrombocytopenia
Nausea, vomiting, swelling or tenderness in neck.
Pain on swallowing, sore throat, sickness, alopecia.

**Nursing considerations:**
- Only given to hospitalized patients.
- Solution may be darken upon storage, this not affect efficacy.
- Take complete nursing history (for sensitivity) prior to administration.
- If patient take antithyroid drugs 2-3 days before discuss with the physician & reassure patient.
- Institute proper measures to protect visitors & health personnel.
- Increase fluid intake to promote excretion. (through the kidney).
**Oral Contraceptives**  
Estrogen- Progesterone Combinations

- The most effective form of birth control available.
- There are 3 types of combinations:
  1- Monophasic: contain the same amount of estrogen & progesterone in each tablet.
  2- Biphasic: contain the same amount of estrogen in each tablet but the progestin content is lower for the first 10 days of the cycle & higher in the last 11 days.
  3- Triphasic: The estrogen content may be the same or may vary throughout the medication cycle. The progestin content vary.

N.B.: The purpose of biphasic & triphasic products is to give or provide hormones in a manner similar to that occurring physiologically.

- Other types of oral contraceptives is the progestin-only (mini-pill) product which contain a small amount of progestin in each tablet.

**Action:**
- Inhibit ovulation due to inhibition of L.H. & F.S.H. (by negative feedback mechanism) which are necessary for development of the ova, changes in the endometrium & cervical mucosa so that the penetration of sperm & implantation of ova not take place.
- Promote the regularity of the cycle.
- Decrease incidence of dysmenorrhea.
- Decrease blood loss during menstruation.
- Decrease incidence of endometrial cancer, ectopic pregnancy & pelvic inflammatory diseases.

**Uses:**
- Contraception
- Menstrual irregularities
- Menopausal symptoms
- Endometriosis & hypermenorrhea.
**Contraindications:**
- History of cerebrovascular diseases.
- Hypertension
- Cancer breast
- Impaired hepatic function
- Renal or cardiac diseases.

**Side effects:**
- Hypertension, weight gain, oily skin, hairsuitism
- Headache, nausea, dizziness
- Breast tenderness, increase in breast size.
- Anxiety & decrease in menstrual flow.
- Decrease the quantity & quality of breast milk.

**Nursing considerations:**
1- Tablets should be taken approximately at the same time each day, with meal or at bedtime.
2- Spotting bleeding may occur 1-2 first days of the cycle, if continue notify the physician.
3- For the 21 day regimen, tablet is taken daily beginning on day 5 of the cycle (No tablets are taken for 7 days).
4- For the 28 day regimen, tablets are taken for the first 21 days following by 7 days of iron containing tablets.
5- If a woman fails to take one or more tablets, the following recommendations should be followed:
   - If 1 tablet is missed, It should be taken as soon as it is remembered, alternatively 2 tablets can be taken the following day.
   - If 2 tablets are missed, 2 tablets can be taken each day for 2 days, alternatively 2 tablets can be taken on the day the missed tablets are remembered with the second missed tablet being discarded.
   - If 3 tablets are missed, a new medication cycle should be initiated 7 days after the last tablet was taken & additional contraceptive method should be used until the start of the next menstrual period.
6- Advise the client if she develops pain in the legs or chest, or dizziness to discontinue the therapy & notify the physician.
7- Advise the client prior to initiate therapy that there is a high risk for cancer of breast.
8- Instruct client to avoid smoking.
9- If a woman is a breast-feeding, instruct her to find other form of contraception.

**N.B.:**
“ACHES” system: Pill danger signs.
A = Abdominal pain (sever).
C = chest pain (sever) or shortness of breath.
H = Headache (sever).
E = Eye problems (loss of vision, blurred vision).
S = Sever leg pain (calf or thigh).
**Diuretics**

The kidney is a complex organ with 3 main functions:

1- Maintain the acid-base balance.
2- Elimination of waste materials & return of useful metabolites to the blood.
3- Maintenance of an adequate electrolyte balance, which in turn governs the amount of fluid retained in the body.

** Malfunction of one or more of these regulatory processes may result in the retention of excessive fluid by various tissues (edema).**

** Edema is an important manifestation of many conditions such as pregnancy & congestive heart failure.**

**Action of diuretics:**

It increase the urinary output of water and sodium “ prevention or correction of edema” through one of the following mechanisms:

1- Increasing the glomerular filtration rate.
2- Decreasing the rate at which sodium is reabsorbed from the glomerular filtrate by the renal tubules, therefore water is excreted along with sodium.
3- Promoting the excretion of sodium & therefore water by the kidney.

**Uses:** Congestive heart failure, hypertension, and edema.

1- **Carbonic Anhydrase Inhibitor Diuretics:**

Acetazolamide

Trade name : Diamox. (Studied before)

2- **Loop Diuretics:**

Furosemide

Trade name : Fused , Lasix

Class: Loop diuretic.

Action:
It inhibits the reabsorption of sodium and chloride in the ascending loop of Henle resulting in the excretion of sodium, chloride & to a lesser degree potassium & bicarbonate ions. Also it decrease the reabsorption of sodium & chloride & increase the excretion of potassium in the distal tubule.

**Uses:**
- Edema associated with:
  - Congestive heart failure
  - Liver cirrhosis
  - Nephrotic syndrome.
  - Acute pulmonary edema.
  - Hypertension.

**Contraindications:**
- Hepatic coma associated with electrolyte depletion.
- Anuria
- Sever renal diseases.
- Hypersensitivity.

**Side effects:**
- Dehydration, hypovlemia.
- Hypokalemia, hyperglycemia, Hyponatremia
- Nausea, vomiting, diarrhea, anorexia.
- Tinnitus, blurring of vision, headache, orthostatic hypotension, rashes & photosensitivity.

*After I.V use: Thrombophlebitis & cardiac arrest.*
*After I.M use: pain at injection site.*

**N.B.:**
Because the drug potentates the effects of muscle relaxants, it is recommended to discontinue oral medication 1 week before surgery & the I.V. 2 days before surgery

**Forms:**
Tablets 40 mg.
Ampules 20 mg /2ml, 250 mg /10 ml.

**Dose:**
- oral: 20-80 mg as a single dose.
- I.V: 20-40 mg as a single dose.
  - For hypertensive crisis:100-200 mg.

**Nursing considerations:**
1- When high doses are required, administer lasix by infusion.
2- Store in a light-resistant container.
3- Monitor serum electrolytes & for signs of hypokalemia.
4- Observe client for signs of dehydration & circulatory collapse.
5- Monitor pulse & blood pressure.
6- Advise the client to take medication in the morning to avoid interruption of sleep.
7- Discuss the need for a diet high in potassium.

**3- Osmotic Diuretics:**

**Mannitol**

**Trade name:** Osmitrol
**Class:** Osmotic diuretic.
**Action:**
Increase the osmolarity of the glomerular filtrate which decrease the reabsorption of water while increasing the excretion of sodium and chloride.

**N.B.:**
It also increases the osmolarity of the plasma which cause increase flow of water from tissues to the interstitial fluid & plasma, thus cerebral edema, increased intracranial pressure & CSF volume & pressure are reduced.

**Uses:**
- Acute renal failure
- Cerebral edema
- To decrease intracranial pressure
- Glaucoma

**Contraindications:**
- Anemia
- Dehydration
- Pulmonary edema

“Progressive heart failure or pulmonary congestion after mannitol therapy”.

**Side effects:**
- Hypernatremia, electrolyte imbalance, acidosis
- Dehydration, dry mouth, thirst, edema, hypotension & hypertension, blurring of vision, headache, dizziness.

**Dose:**
50 ml of 25%, 75 ml of 20% or 100 ml of 15% solution infused over 3-5 minutes.

**Nursing considerations:**
1- Mannitol should not be added to other I.V. solutions nor should it be mixed with other medications.
2- If blood is to be administered at the same time, add 20 mEq of sodium chloride to each liter of mannitol to prevent pseudoagglutination.
3- Monitor & record vital signs.
4- Observe for signs of electrolyte imbalance or dehydration.
5- Observe for signs, & symptoms of pulmonary edema (dyspnea, cyanosis, frothy sputum).

“Slow the rate & notify the physician”.

4 _ Potassium – Sparing Diuretics:

**Spironolactone**

**Trade name :** Aldactone.

**Class:** Diuretic – potassium sparing.

**Action:**
- Is a mild diuretic that acts on the distal tubule to inhibit sodium exchange for potassium which results in increased secretion of sodium and water & conservation of potassium.
- It is also aldosterone antagonist.
- It has slight antihypertensive effect.

**N.B.:**
It also interferes with syntheses of testosterone & may increase formation of estradiol from testosterone thus leading to endocrine abnormalities.

**Uses:**
- Edema due to congestive heart failure
- Liver cirrhosis.
- Nephrotic syndrome.
- Essential hypertension.
- Primary hyperaldosteronism.
- Hypokalemia (as in CHF).

**Contraindications:**
- Acute renal insufficiency.
- Progressive renal failure.
- Patients receiving potassium supplement.
- Hyperkalemia.

**Side effects:**
- Hyperkalemia, hyponatremia (dry mouth, lethargy, thirst & easy fatigability).
- Vomiting, diarrhea, and cramps.
- Menstrual irregularities, gynecomastia, hirsutism & deepening of voice, impotence.
- Skin rashes & breast carcinoma.

**Dose:** 100 mg (1 tab) per day.

**Nursing consideration:**
- Protect drug from light.
- Food may increase absorption of aldactone.
- Obtain serum electrolyte levels prior to starting therapy.
- Record vital signs, intake & output & body weight.
- Advise the client to avoid food high in potassium.

**5-Thiazides & related diuretics:**

**Action:**
Promote diuresis by decreasing the rate at which sodium & chloride are reabsorbed by the distal renal tubules of the kidney, thus force excretion of additional water, also increase the excretion of potassium & the excretion of calcium & uric acid.

**N.B.:**
- It is chemically related to sulfonamides.
- It has antihypertensive effect by direct dilation of arterioles as decrease total blood volume.

**Uses:**
Edema due to congestive heart failure, nephrosis, liver cirrhosis & renal failure.

**Contraindications:**
- Hypersensitivity
- Impaired renal function
- Edema due to toxemia of pregnancy (adverse of effect on the newborn).
- Hypokalemia.

**Side effects:**
- Hypokalemia (cardiac arrhythmias).
- Hyponatremia (nausea, vomiting, lethargy, epigastric distress).
- Dry mouth, diarrhea, easy fatigability.
- Skin rashes, muscle cramps.
- Hyperglycemia.

**Nursing considerations:**
See Furosemide (Lasix).

**Example**

Hydrochlorothiazide

**Trade name:** Esidrex.