Posology

❖Posology and Dosage Regimen:

- **Posology:** (Derived from the Greek ***posos***- how much, and ***logos***- science) is the branch of medicine/pharmacy dealing with doses.
- "Posology is a branch of medical science which deals with dose quantity of drug which can be administered to a patient to get the desirable pharmacological action."
- **Dose:** is the quantitative amount administered or taken by a patient for the intended medicinal effect.

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❖Factors Affecting Drug Dosage:

1) Age:

- **Newborn Infants (Pediatric):**
  - Sensitive to certain drugs because of the **immature state of their hepatic and renal function**
  - **Failure to detoxify and eliminate drugs** results in their accumulation in the tissues to a toxic level.
- **Elderly Patients (Geriatric):**
  - The **decline in renal and hepatic function** may slow drug clearance and increases the possibility of drug accumulation in the body and subsequent toxicity.
  - Elderly individuals may also respond abnormally to the usual amount of a drug because of **age-related alterations in target tissues and organs.**

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Various rules of dosage in which the pediatric dose was a fraction of the adult dose:

1. Young's Rule, based on age:

For calculating doses for children 12 years of age.

$$\text{Dose for child} = \text{Adult dose} \times \frac{\text{Age}}{\text{Age} + 12}$$

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2- Cowling's Rule:

For calculating doses for children two years of age or older.

$$\text{Dose for child} = \text{Adult dose} \times \frac{\text{Age at next birthday (in years)}}{\text{Age} + 12}$$

3- Fried's Rule for Infants:

For calculating doses for infants younger than one year of age.

$$\text{Dose for infant} = \text{Adult dose} \times \frac{\text{Age (in months)}}{150}$$

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4- Dilling's Rule:

For calculating doses for 4 to 20 yrs age.

$$\text{Dose Required} = \text{Adult dose} \times \frac{\text{Age (in yrs)}}{20}$$

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Rule	Age	Formula
Young's Rule	12 Yrs	Adult Dose X (Age/Age+12)
Cowling's Rule	>2 Yrs	Adult dose X [Age at next birthday (in years)/24]
Fried's Rule for Infants	Infants <1 Yr	Adult dose X (Age in months/150)
Dilling's Rule	2- 20 Yrs	Adult dose X (Age in Yrs/20)

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2) Body Weight:

- The official usual doses for drugs are considered suitable for 70 kg (150 pounds) individuals.
- The ratio between the amount of drug administered and the size of the body influences the drug concentration at the site of action.
- Therefore, drug dosage may require adjustment from the usual adult dose for abnormally lean or obese patients.

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To calculate the dose of a drug for children based on body weight:

- The determination of drug dosage for children on the basis of body weight is more dependable than that based on age.

- **Clark's Rule:**

$$\text{Dose for child} = \text{Adult dose} \times \frac{\text{Weight in pounds}}{150}$$

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3) Body Surface Area:

- A close relation exists between a large number of physiological processes and body surface area (BSA).
- Many physiological factors such as **plasma volume, oxygen consumption, body electrolyte are proportional to the surface area.**
- The surface area used to calculate dose.
- Eg. Anticancer drug Methotrexate is administered on mg per sq.mm of body surface.
- **Average body surface area of a 70kg adult is 1.7 to 1.8 sq.meters**

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- To calculate the dose of a drug for children based on body surface area as related to weight:
- Many physicians believe that doses for children should be based upon body surface area, since the correct dosage of drugs seems more proportional to the surface area.

$$\text{Approximate dose for child} = \text{Adult dose} \times \frac{\text{BSA of child (in m}^2\text{)}}{1.8\ \text{m}^2\ \text{(average adult BSA)}}$$

If the dose per m^2 is given,

$$\text{Approximate dose for child} = \text{Dose per m}^2 \times \text{BSA of child (in m}^2\text{)}$$

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4) Sex:

- **Women are more susceptible** to the effects of certain drugs than are men.
- On the basis of body weight **female adults generally requires smaller doses than males.**
- **Because % of adipose tissue is greater and % of water is lower** in adult females as compared to adult males.
- **Pregnant women and nursing mothers** should use medications only with the advise and **under the guidance of their physician.**

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- Examples of drugs that are transported from the maternal to the fetal circulation e.g. alcohol, anesthetic gases, barbiturates, anticoagulants, etc.
- Because of the undeveloped drug detoxification and excretion mechanisms present in the fetus, concentrations of drugs may reach a higher level in the fetus than in the maternal circulation.
- The transfer of drugs from the mother to the nursing infant through human milk may occur with various drugs with the drug effects becoming manifest in the infant.

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5) Pathological State:

- Because of pathological conditions **like renal function impairments or liver disease** many drugs remain in the body for longer period of time.
- The effects of certain drugs may be modified by the pathological condition of the patient and must be considered in determining the dose.
- Warning and precautions are used in the drug labeling to alert the physician to certain restrictions in the use of a particular drug.

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Precaution:

- It is used to advise the prescriber of **some possible problems** attendant with the use of the drug. It is less restrictive than warning.
- Ex: The use of tetracycline antibiotic may result in overgrowth of fungi.

Warning:

- It is used when the potential for **patient harm is greater** than in instances in which the precaution is used.
- Ex: If tetracycline is used in the presence of renal impairment, it may lead to accumulation of the drug and possible liver toxicity.
- So, lower than usual doses are indicated.

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Contraindication:

- A term that used to indicate an **absolute prohibition to the use of a drug** in the presence of certain stated conditions.
- It is the **most restrictive of the warnings** which limits the use of drugs.

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6) Route of Administration:

- Drugs administered intravenously enter the blood stream directly and thus the full amount administered is present in the blood.
- In contrast, drugs administered orally are rarely fully absorbed due to the various physical, chemical and biologic barriers to their absorption, including interactions with the gastric and intestinal contents.
- Thus, a lesser parenteral dose of a drug is required than the oral dose to achieve the same blood levels of drug.

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7) Time of Administration:

- The time at which a drug is administered sometimes influences dosage. This is specially true for oral therapy in relation to meals.
- Absorption proceeds more rapidly if the **stomach and upper portions of the intestinal tract are free of food, and an amount of a drug that is effective when taken before a meal** may be ineffective if administered during or after eating.
- **Gastric emptying rate** affect dose.
- **Irritating drugs** are better tolerated by the patient if food is present in the stomach to dilute the drug's concentration.

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8) Frequency of Administration:

- Drugs having **short half-life** gets rapidly excreted from the body.
- In such case, to maintain steady state plasma concentration it requires frequent dosing.
- Hence controlled or sustained release formulations are developed.

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9) Additive Effect:

- Total pharmacological action of 2 or more drugs administered together is equivalent to the sum of their individual pharmacological action.
- Ex. Combination of Ephedrine and Aminophylline for the treatment of bronchial asthma.

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10) Synergism:

- When 2 or more drugs used in combination, then total pharmacological action is the combination is increased.
- It is useful when desired therapeutic result needed is difficult to achieve with a single drug.
- Ex. Procaine and Adrenaline combination increases the duration of action of Procaine.

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11) Antagonism:

- The action of one drug is opposed by the other drug on same physiological system
- This phenomenon is generally applied in the treatment of poisoning.
- Ex. Milk of magnesia is given in acid poisoning
- Ex. Adrenaline – Vasoconstrictor

  Acetylcholine – Vasodilator

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12) Tolerance:

- The **ability to endure the influence of a drug**, particularly when acquired by a **continued use** of the substance.
- Tolerance occurs commonly in such drugs.
- e.g. Anti-histaminics, Narcotic Analgesics.
- **Drug tolerance:** When usually large dose of drug is required to elicit a normal pharmacological action is knows as Tolerance.
- **Types of Tolerance:**
  - True tolerance: Produced by oral and parenteral administration of drugs.
  - Pseudo tolerance: Produced only to the oral route of administration.

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- **The development of tolerance can be minimized by:**
  - Initiating therapy with the lowest effective dose.
  - Avoiding prolonged administration.
- Eg. Smokers can tolerate more nicotine.
- Alcoholics can tolerate more alcohol .

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13) Elimination of Drug:

- Body considers drugs as foreign substances and continuously works at eliminating them.
- **Hydrophilic Drug: Easily eliminated**
- **Hydrophobic drug: Dissolved in fat & lipoidal membrane**
- Hence doses of hydrophilic drug requires more than that of hydrophobic drugs.

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14) Idiosyncrasy & Hypersensitivity:

- **Idiosyncrasy** is defined as **"Genetically determined abnormal or unusual response to a drug."**
- **Hypersensitivity** or drug allergy is an adverse to particular chemical resulting from a previous exposure to the substance, occurring in only a small fraction of all people receiving the particular drug.
- eg. Skin rashes, edema, anaphylactic shock, broncho-spasm etc.
- eg. Sometimes small quantity of Aspirin causes gastric hemorrhage and Quinine causes ringing sensation in ears.

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15) Tachyphylaxis:

- When certain drugs are **administered repeatedly at short interval**, the **cell response get blocked & pharmacological response to that particular drug is decreased.**
- **The decreased response can not be reversed by increasing dose.**
- Eg. Ephedrine in treatment of bronchial asthma at short intervals may produce very less response due to tachyphylaxis.

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Question Bank

2 Marks

- Define posology & state Dilling's formula for calculating doses for children.
- Give Clark's and Young's formula for the calculation of doses.
- Give Young's and Dilling's formula for the calculation of doses.

5 Marks

- Short Note: Posology

10 Marks

- Define posology and discuss the factors affecting does of drug & action of drug on human body.
- What do you mean by dose? Explain the factors affecting doses and action of drug on the human body.

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