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.

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.

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.

   
   \[
   \text{Dose for child} = \text{Adult dose} \times \frac{\text{Age}}{\text{Age} + 12}
   \]
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.

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

4. **Dilling’s Rule:**
   For calculating doses for 4 to 20 yrs age.

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

### Rule | Age | Formula
--- | --- | ---
**Young’s Rule** | 12 Yrs | Adult Dose X \( \frac{\text{Age}}{\text{Age+12}} \)
**Cowling’s Rule** | >2 Yrs | Adult dose X \( \frac{\text{Age at next birthday (in years)}}{24} \)
**Fried’s Rule for Infants** | Infants <1 Yr | Adult dose X \( \frac{\text{Age (in months)}}{150} \)
**Dilling’s Rule** | 2-20 Yrs | Adult dose X \( \frac{\text{Age in Yrs}}{20} \)

### 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.
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:**

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

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

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.
- 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.

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.

**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.

**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.
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.

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.

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.

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.
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.

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

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 known 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.

- 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.
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.

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.

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.

**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 doses 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.