POSOLOGY

The word posology is derived from 2 Greek words "Posos"-how much, "logos"-science. So "Posology is a branch of medicine which deals with the calculation of dose for individual patient, especially for infants, Children and geriatric patients".

The dose should be of minimum amount for eliciting the desired therapeutic response and maximum amount that can be tolerated by the patient.

FACTORS AFFECTING THE DOSE

1. **AGE:**
   - The physiological conditions of infants, children and elderly patient is different than an adult.
   - In children kidneys and liver are not fully developed and their efficiency is reduced in old age .So, comparatively lesser dose is required than an adult.
2. **BODY WEIGHT:**
   - The relative proportion of muscular and adipose tissue in the individuals governs the distribution and clearance of a drug from the body.
   - Therefore, a dose for children is usually calculated on body weight basis, in terms of mg/kg/day.
   - Because of higher metabolic rate, children generally require higher dose per kilogram than adults.
   - But in obese children, it is better to calculate a dose based on, ideal body weight of the child, of that particular age.
3. **SURFACE AREA:**
   - Many physiological factors such as plasma volume, oxygen consumption, and requirement of body fluid electrolytes, calories and glomerular filtration are proportional to the surface area.
   - It is more important in case of anti-cancer drug calculation. In anti-cancer therapy, drug is calculated as, mg per sq.m of body surface.
4. **SEX:**
   - On the basis of weight, female adults generally require smaller dose than males, as there is unequal distribution of lean body mass or fat mass.

- The percentage of adipose tissue is greater than that of water in adult female, as compared to males.

5. **SEVERITY OF DISEASE AND PATHOLOGICAL CONDITIONS:**
   - More the severe disease, higher the dose required.
   - Because of pathological conditions like renal failure impairment or liver disease, many drugs remain in the body for longer period of time.
6. **GENETIC DIFFERENCE:**
   - Sometimes there is variation in response in different individuals to the same dose of the drug due to genetic difference.
   - For example-Isoniazid, an anti-tuberculosis drug is excreted faster in black patients, so higher dose is required, whereas it is excreted slowly in white patients, therefore less dose is required.
7. **AQUIRED TOLERANCE:**
   - It is developed due to prolonged intake of drug.
   - So comparatively higher dose of a drug is required to produce particular effect, at time same dose may be harmful to normal patient.
   - This is especially developed in drugs like sedatives, and narcotic substance.
8. **IDIOSYNCRASY:**
   - This term indicates, exceptional or individual tolerance towards certain drugs.
   - For example- certain people show allergic reactions towards penicillin.
9. **ROUTE OF ADMINISTRATION:**
   - Generally, lesser dose is required by parental route as compared to oral route.
10. **TIME OF ADMINISTRATION:**
    - Since, most of the drugs have better absorption from small intestine, they reach the site of absorption if taken on an empty stomach.
    - Thus any change in gastro intestinal emptying rate is likely to effect the dose.
    - A number of drugs require to be given in higher doses, if given after a meal.
    - For example-Ferrous sulphate if administered in between meals is more effective than when administered immediately after meals.
11. **DRUG-DRUG INTERACTION:**
    - Administration of two or more drugs may change pharmacological action of each other. They may increase or decrease the action.
    - They may produce synergistic effect, antagonist effect or additive effect.

CALCULATION OF DOSES

A. ACCORDING TO AGE:

1. YOUNG'S FORMULA:

$$\text{Children Dose} = \frac{\text{Age (years)}}{\text{Age} + 12} \times \text{Adult Dose}$$

This formula is used to calculate dose of children below 12 years of age.

2. COWLING'S FORMULA:

$$\text{Child Dose} = \frac{\text{Age (years)} + 1}{24} \times \text{Adult Dose}$$

3. FRIED'S FORMULA:

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

4. BASTEDO'S FORMULA:

$$\text{Child Dose} = \frac{\text{Age (Years)} + 3}{30} \times \text{Adult Dose}$$

5. DILLING'S FORMULA:

$$\text{Child Dose} = \frac{\text{Age (years)}}{20} \times \text{Adult dose}$$

GAUBIN'S CHART

AGE	PARTS OF ADULT DOSE	AGE	PARTS OF ADULT DOSE
Under 1 year	1/12	14-20 years	2/3
From 1-2 year	1/8	21-60 years	Full adult dose
2-3 year	1/6	60-70 years	4/5
3-4 year	¼	70-80 years	2/5
4-7 year	1/3	Over 90 years	½
7-14 year	½		

EXERCISE 1.1: If the adult dose of paracetamol is 500mg, what will be the dose for a child of 4 years?

$$\frac{4}{4+12} \times 500 = 124\text{mg}$$

Thus, the dose of a child of 4 years of paracetamol is 125mg.

EXERCISE 1.2: If the adult dose of ampicillin is 250-500mg 3-4 times/day. What will be the dose of the child of age of 10 years?

a. $\frac{10}{20} \times 250 = 125\text{mg}$

b. $\frac{10}{20} \times 500 = 250\text{ mg}$

Ampicillin 125mg and 250 mg capsule.

EXERCISE 1.3: Haloperidol, an antipsychotic drug, can be given to adults in doses of 5mg, 2 to 3 times a day. What will be the dose for a 6 month old infants, a child of 5 years and a boy of 16 years?

a. Dose for an infant of 6 months: According to Frieds's formula = $\frac{6}{}$ x 5mg = 0.2mg

b. Dose for a child of 5 years :

According to Young's formula = $\frac{5}{5+12} \times 5\text{mg} = 1.47\text{mg}\ (1.5\text{mg})$

c. Dose for a boy of 16 years: According to Dilling's formula = $\frac{16}{20} \times 5 = 4\text{mg}$

B. ACCORDING TO BODY WEIGHT:

1. CLARK'S FORMULA:

$$\text{Child dose} = \frac{\text{Weight (pounds)}}{150} \times \text{Adult dose}$$

OR

$$\text{Child dose} = \frac{\text{Weight (Kg)}}{70} \times \text{Adult dose}$$

EXERCISE 2.1: The adult dose of Nimesulide is 100mg b.i.d. (Latin – bis in die; Meaning – Twice a day). What should be the dose for a child of 30 Kg?

$\frac{30}{70} \times 100 = 43\text{mg b.i.d.}$

EXERCISE 2.2: How many theophylline tablets, each containing 200mg are needed to provide 13mg/kg/day in divided doses for a week for patient weighting 50kg?

The dose of theophylline is 13mg/kg/day

Therefore,

For 50kg patient, 13mg x 50kg = 650mg.

Since each tablet is of 200mg. 1 tablet 3 times a day is suitable dose.

Therefore,

For 7 days, 21 tablets are required.

C. ACCORDING TO SURFACE AREA:

$$\text{Log } S = 0.425 \log W + 0.725 \log H + 1.85$$

Where; W = Weight in Kg

H = Height in cm

S = Surface area in m^2

FORMULA TO CALCULATE CHILD DOSE USING SURFACE AREA IS,

$$\text{Child dose} = \frac{\text{Surface area of child } (m^2)}{1.8} \times \text{Adult dose}$$

EXERCISE 3.1: If adult dose of mefenamic acid is 500mg t.i.d. (Latin – Ter in die; Meaning – thrice a day), what will be the dose for a 3 month old child, who is suffering from juvenile idiopathic arthritis? Calculate it in percent of an adult dose.

$$\text{Child dose} = \frac{0.32}{1.8} \times 500 = 88\text{mg}$$

Adult dose is 500mg. Therefore, 88mg is 18 % of adult dose.

D. PERCENTAGE METHOD:

AGE	BODY WEIGHT(Kg)	HEIGHT (Cm)	BODY SURFACE AREA (m^2)	PERCENTAGE OF ADULT DOSE
>1 Month	3.4	50	0.23	12.5
1 Month	4.2	55	0.26	14.5
3 Month	5.6	59	0.32	18
6 Month	7.7	67	0.40	22
1 Year	10	76	0.47	25
2 Year	14	94	0.62	33
3 Year	18	108	0.73	40
7 Year	23	120	0.88	50
12 year	37	148	1.25	75

VETERINARY DOSE CALCULATIONS

The manner in which a drug may effect an animal and the level of immobilization produced are subject to a number of factors. In addition to the animal's weight, its age, sex, physical condition, and mental state at the time of injection, individual animals will have varying degrees of sensitivity to the drug. This can produce different and unexpected results from one individual to another, even within the same species. Excitable animals will usually require a higher dosage than animals which are calm. Also females may require a higher dosage than males to produce a satisfactory level of immobilization.

In order to correctly calculate the drug dosage required to immobilize a particular animal, the person must know three factors.

1. **Estimated weight of the animal:**
   - If the weight of the animal is estimated in pounds (lbs), it should be converted to kilograms (kg), as dosages are expressed in mg/kg (milligram of drug per kilogram of body weight) required to produce immobilization.
   - One pound equals .454kg, and the conversion is made by multiplying the estimated pounds by .454. Thus a 100lb animal weighs 45.4kg.
   - Since 1lb is almost equal to 1/2kg, a simpler conversion can be made by dividing the estimated weight in pounds by 2.
   - By this method the 100lb animal weighs 50kg.
   - Because of the difficulty in accurately estimating the weight of an animal and the safety margin of the CNS drugs, this simpler conversion is acceptable for fieldwork.

2. **The dosage recommended for the species:**
   - This is the dosage recommended to produce immobilization in a particular species.
   - Dosage recommendations may be provided by a veterinarian, by the drug package insert, or by consulting dosage tables in reference literature.
   - The suggested dosage tables are given in mg/kg (milligram of drug per kilogram of body weight).

3. **Concentration of the drug used:**
   - The concentration (solution strength) of the drug is listed on the label of the vial, on the package, and in the package insert.
   - It is given as mg/ml (milligram of drug per milliliter of liquid volume).
   - To minimize the drug volume, and consequent size of the RDD, the highest available concentration of a given drug should be used.

On the basis of these three factors, the drug dosage is calculated as follows:

Animal weight (kg) x dosage (mg/kg) / concentration of drug (mg/ml) = drug volume in ml or cc.