Volume of Distribution

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Volume of Distribution (Vd)

- **Defined as the total volume of body fluids in which a drug appears to be distributed according to its concentration in the blood or plasma.**

- **It is an apparent volume**

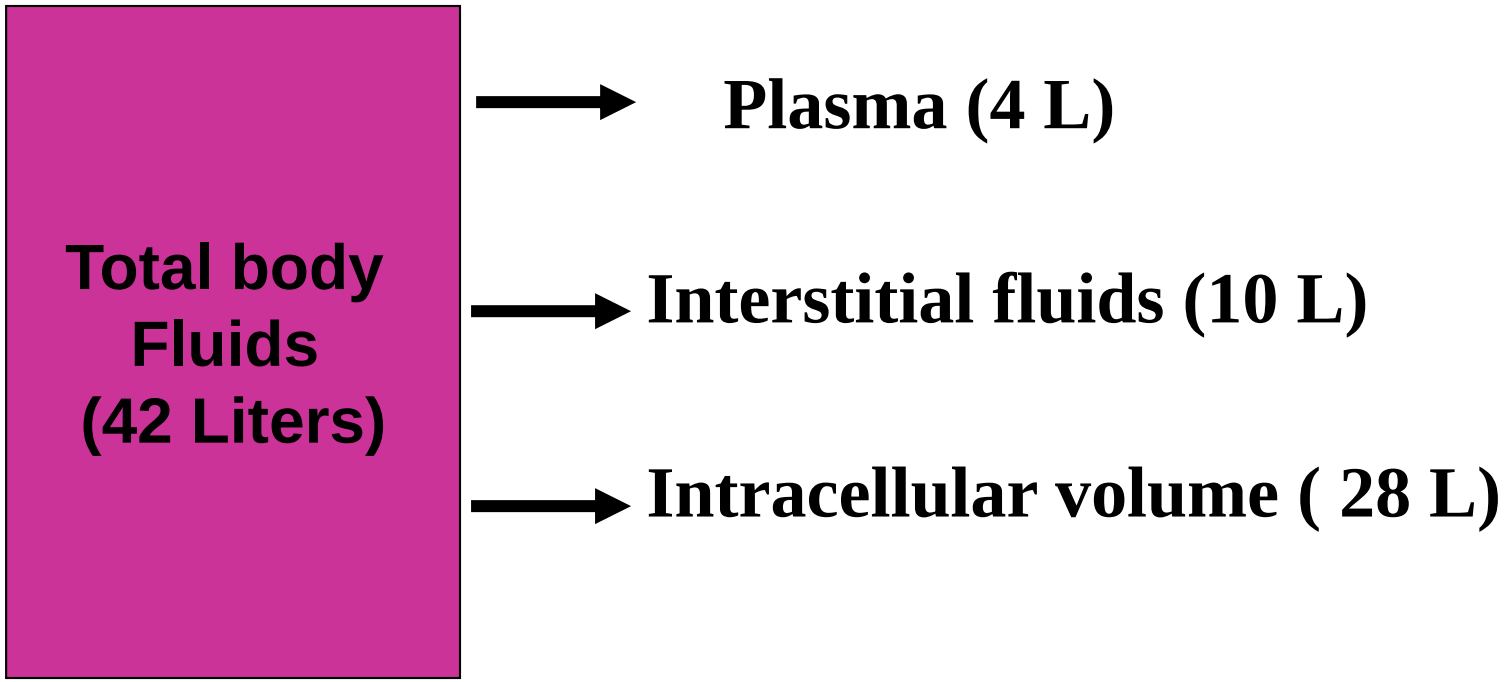
e.g chloroquine 13000L/70kg

The major body fluid compartments are

- **Extracellular fluid (22%)**
  - Plasma (5 % of body weight = 4 liters).
  - Interstitial fluid (16 % = 10 liters).
  - Lymph (1 %).

- **Intracellular fluid (35 %)**
  - fluid present inside cells (28 L).

Total body fluids
(60% of body weight in 70-kg individual)



Volume of Distribution (Vd)

- **It relates the amount of drug in the body to the concentration of drug in blood and is calculated by the following formula:**

$$Vd\ (L) = \frac{\text{Total amount of drug in body (mg)}}{\text{Concentration of drug in blood (mg/L)}}$$

Volume of Distribution (Vd)

- **Vd can vastly exceed any physical volume in the body because it is the volume apparently necessary to contain the amount of drug homogenously at the concentration found in blood**

- **It represents balance between drug which is distributed in body tissue and the plasma.**

Volume of Distribution (Vd)

- **V_d is directly correlated with the amount of drug distributed into tissue**
- **a higher V_d indicates a greater amount of tissue distribution.**
- **V_d greater than the total volume of body fluids (approx 42 L in humans) indicate that the drug is highly distributed into tissue.**

Factors affecting the Vd of a Drug:

- **lipid solubility**

↑ lipid sol ↑ Vd

- **Plasma protein binding**

↑ PPB ↓Vd

- **Tissue Binding**

↑ BT ↑ Vd

- **Body fat**

In obese ↑Vd e.g theophylline and ↓ Digoxin

- **Diseases like CCF, Renal failure**

↑Vd e.g Gentamicin a hydrophilic drug

Volume of Distribution (Vd)

Drugs with high Vd

- Have higher concentrations in tissues than in plasma.
- Relatively lipid soluble.
- Distributed intracellularly
- Not efficiently removed by haemodialysis.
- e.g. phenytion, morphine, digoxin

Volume of Distribution (Vd)

Drugs with low Vd

- confined to plasma & interstitial fluid.
- distributed in extracellular compartments.
- Polar drugs or lipid insoluble drugs. e.g. Carbenicillin, gentamycin.
- High MW e.g. heparin – insulin.
- High plasma protein binding e.g. warfarin.
- Do not cross BBB or placental barriers.
- Easily Removed by Haemodialysis

THANKS

The End