

Short Commentary

Medication Dosing and Body Weight

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Received: August 21, 2022; Accepted: August 25, 2022; Published: August 31, 2022

Introduction

Patient’s weight is a crucial consideration in medication dosage since the size of the body affects the concentration of the drug in body fluids and at the site of action. Dose calculation based on body weight became standard for certain medications dosing. Dosing based on patient’s specific weight makes the drug quantity administered specific to the patient being treated. Gender, age, weight, pregnancy, albumin in blood, diet, medication type, gastrointestinal function and kidney function they are all factors altering drug response [1].

Measures of Weight

- Direct: Underwater weighing (hydrodensitometry), Skinfold measurement, Dual-energy x-ray absorptiometry (DEXA) and Bioelectrical impedance analysis (BIA) [1].
- Indirect (Table 1).

How Does a Person’s Body Weight Affect Drug Response (Drug Distribution and Metabolism)

After a drug is absorbed into the bloodstream, it rapidly circulates through the body. The average circulation time of blood is 1 minute. As the blood recirculates, the drug moves from the bloodstream into the body’s tissues for example: fat, muscle, and brain tissue. Once absorbed, most drugs do not spread evenly throughout the body. Drugs that dissolve in water (water-soluble drugs), tend to stay within the blood and the fluid that surrounds cells. Drugs that dissolve in fat (fat-soluble drugs), tend to concentrate in fatty tissues. Other drugs concentrate mainly in only one small part of the body

for example: iodine concentrates mainly in the thyroid gland; because the tissues have a special attraction for affinity and the ability to retain that drug. Factors affecting drug distribution: plasma protein binding, physicochemical properties of the medication (lipophilicity, hydrophilicity), tissue blood flow and membrane transporters. Body composition in a normal body weight and obese patients, 20% from normal body weight is adipose weight and 80% lean weight, however, 40% from obese patient weight is adipose tissue and 60% is lean weight. Hydrophilic drugs excreted by renal clearance, has low volume of distribution, low Intracellular penetration and high extracellular distribution in comparison to lipophilic drugs that are excreted by hepatic clearance has high volume of distribution, high Intracellular penetration and low extracellular distribution [2-7] (Tables 2 and 3).

References

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Table 1: Measures of Weight [1].

Body mass index (BMI)	Ideal Body Weight (IBW)	Actual body weight (ABW)	Adjusted body weight (AdjBW)	Lean body weight (LBW)	Body Surface Area (BSA)	Predicted normal weight (PNWT)
Equation: kg/m ² WHO’s preferred measure for classifying obesity: Pre-obesity: BMI 25-29.99 kg/m ² Obesity class I: BMI 30-34.99 kg/m ² Obesity class II: BMI 35-39.99 kg/m ² Obesity class III (morbid obesity): BMI ≥40 kg/m ²	Female: 45.4 kg+0.89X (Ht in cm-152.4) Male: 49.9 kg+0.89X (Ht in cm-152.4)	This is a patient’s real weight Called total body weight (TBW)	AdjBW (kg)=IBW+0.4 (TBW-IBW)	The patient’s weight excluding fat Males: LBW=(9270 xTBW)/(6680+216 xBMI) Females: LBW=(9270 xTBW)/(8780+244 xBMI)	BSA (m ²) = (TBW) ^{0.425} X(height in cm) ^{0.725} X 0.007184 BSA (m ²) = [(TBW) X(height in cm)/3600] ^{1/2}	Predict the expected normal weight of an overweight or obese individual Males: PNWT (kg)=1.57xTBW-0.0183xBMI x TBW-10.5 Females: PNWT (kg)=1.75xTBW-0.0242xBMI x TBW-12.6

Table 2: Hydrophilic and Lipophilic medications [2,4,5].

Medication	Hydrophilic	Lipophilic
Deferoxamine	Yes	No
Benzodiazepines	No	Yes
Tricyclic antidepressants	No	Yes
Aminoglycosides	Yes	No
Amphotericin-B	No	Yes
Vancomycin	Yes	No
Tigecycline	No	Yes
Rocuronium	No	Yes
Rifampicin	No	Yes
Sucrose	Yes	No
Atorvastatin,simvastatin	No	Yes
Propofol	No	Yes
Sufentanil	No	Yes
Thiopental	No	Yes
Rosuvastatin,pravastatin	Yes	No
B-lactam Carbapenem Cephalosporins Penicillin	Yes	No
Daptomycin	Yes	No
Atenolol	Yes	No
Thiazide diuretics	No	Yes
Acyclovir	Yes	No
Voriconazole	No	Yes
Low molecular weight heparin	Yes	No
Lithium	Yes	No
Fentanyl	No	Yes
Phenytoin	No	Yes
Atenolol	Yes	No
Sotalol	Yes	No
Steroids	No	Yes
Fluoroquinolones	No	Yes
Macrolides	No	Yes
Warfarin	Yes	No
Linezolid	No	Yes
Tetracycline	No	Yes
Clindamycin	No	Yes
Captopril, Perindopril, Lisinopril, Enalapril	Yes	No
Fosinopril , Ramipril	No	Yes

Table 3: Weight based medications [6-7].

Medication	Dosing weight	
	Normal weight	Obese
GCSF(Filgrastim)	Actual body weight	Actual body weight
Procainamide	Ideal body weight	Ideal body weight
Erythromycin	Ideal body weight	Ideal body weight
Phenytoin	Ideal body weight	LD: AdjBW MD: IBW
Fluconazole	Ideal body weight	Total body weight
Thiopental	Ideal body weight	LD: IBW MD: ABW
Succinylcholine	Ideal body weight	Total body weight
Rocuronium	Ideal body weight	Ideal body weight
Vecuronium	Ideal body weight	Ideal body weight
Propofol	Total body weight	Induction: IBW Maintenance: AdjBW
Heparin	Ideal body weight	Adjusted body weight
Enoxaparin	Ideal body weight	DVT treatment: ABW
Isoniazid	Ideal body weight	Ideal body weight
Ethambutol	Lean body weight	Ideal body weight
Pyrazinamide	40-55 kg → 1000 mg once daily 56-75 kg → 1500 mg once daily 76-90 → 2000 mg once daily	Ideal body weight
Rifampin	Ideal body weight	Ideal body weight
Lidocaine	Ideal body weight	Ideal body weight
Lorazepam	Ideal body weight	LD: ABW MD: IBW
Midazolam	Ideal body weight	Initial dose: TBW Continuous dose: IBW
Acyclovir	Ideal body weight	Ideal body weight
Aminoglycosides	Ideal body weight	Adjusted body weight
Vancomycin	Initial dose: Total body weight, then adjusted according trough concentration	Adjusted body weight
Polymyxin B	Ideal body weight	Adjusted body weight
TMP/SMX	Total body weight	Adjusted body weight
Liposomal amphotericin B	Total body weight	Adjusted body weight
Voriconazole	Total body weight	Adjusted body weight
Flucytosine	Ideal body weight	Ideal body weight
Ganciclovir	Total body weight	Adjusted body weight

Citation:

AlMolaiki MA (2022) Medication Dosing and Body Weight. *J Pharmacol Pharm Res* Volume 5(3): 1-2.