1. True or False

A. It is reasonable to assume that liver function is proportional to BSA. (T)
B. Weakly or moderately lipophilic drugs are poorly distributed in obese patients (T)
C. Total body water (% of body weight) in neonates is usually smaller than in adults (F)
D. Generally, the gastric emptying time of neonates is shorter than adults’ (F)
2. The recommended regimen for a new drug X is 400 mg / m² (BSA) or 10 mg / kg (IBW) once a day. What is the dosage for a patient (male, 35 years-old, 165 cm, and 60 kg) based on BSA and IBW?

BSA can be calculated by:

\[
BSA[m^2] = \left(\frac{TBW[kg]}{70[kg]}\right)^{0.7} \cdot 1.73[m^2]
\]

Or

\[
BSA[m^2] = TBW[kg]^{0.425} \cdot H[cm]^{0.725} \cdot 0.007184
\]

For this patient:

\[
BSA = (60/70)^{0.7} \cdot 1.73 = 1.55 (m^2)
\]

Or

\[
BSA = 60^{0.425} \cdot 165^{0.725} \cdot 0.007184 = 1.66 (m^2)
\]

Ideal body weight can be calculated by:

For male: IBW (kg) = 50 + 0.9*(height in cm - 150)

For this patient: IBW = 50 + 0.9*(165 - 150) = 63.5 (kg)

Dosage based on BSA can be calculated by:

\[
Dosage (mg) = 400 (mg / m^2) \cdot BSA = 400 (mg / m^2) \cdot 1.55 (m^2) = 620 (mg) \text{ or } 400 (mg / m^2) \cdot 1.66 (m^2) = 664 (mg)
\]

Dosage based on IBW can be calculated by:

\[
Dosage (mg) = 10 (mg / kg) \cdot IBW = 10 (mg / kg) \cdot 63.5 (kg) = 635 (mg)
\]
3. A female patient (42 years-old, 155 cm, and 58 kg) has a concentration of serum creatinine of 1.1 mg/dL. Please calculate her $\text{Cl}_{\text{cr}}$ based on the Cockcroft-Gault-Equation.

For female, IBW can be calculated by:

$$\text{IBW (kg)} = 45.5 + 0.9 \times (\text{height in cm} - 150)$$

For this patient: $\text{IBW (kg)} = 45.5 + 0.9 \times (155 - 150) = 50$ (kg)

TBW is smaller than 120% IBW (58<50*120%), so use TBW to calculate her $\text{Cl}_{\text{cr}}$ based on the Cockcroft-Gault-Equation.

For female

$$\text{CL}_{\text{cr}} = \left(\frac{140 - \text{age}}{\text{CP}_{\text{cr}} \cdot 85}\right) \times \text{BW}$$

This patient: $\text{CL}_{\text{cr}} = (140 - 42) \times 58 / 1.1 / 85 = 60.79$ (ml/min)
4. A 50-year-old male patient (60 kg, 160 cm, C_p_{Creat}=1.2 mg/dL,) is treated with 100mg gentamicin i.v. short-term infusions (30 min) Q8h. Assuming linear pharmacokinetics (V_d=0.25L/kg, C_l=C_l_{Creat}), please predict the measured peak concentration 1 hour after the infusion was started and the measured trough concentration 30 min before the next infusion at steady state.

For male: IBW=50 + 0.9*(height in cm - 150) = 50+0.9*(160-150) =59(kg)

TBW=60 (kg) is smaller than IBW*120%, use TBW to calculate the C_l_{Creat}

For male:

\[
C_l_{Creat} = \frac{(140 - \text{age}) \cdot BW}{\text{C_p}_{Creat} \cdot 72}
\]

\[
= (140-50) \cdot 60/1.2/72=62.5 \text{ (ml/min)} =3.75 \text{ (L)}
\]

K=C_l/V_d=3.75/ (0.25*60) =0.25(/h)

T= 0.5 h   t= 0.5 h   \tau = 8 h

\[
C_{max} = \frac{\text{dose}}{V_d \cdot K \cdot T \cdot \left(1 - e^{-k \cdot \tau} \right) \cdot \left(1 - e^{-k \cdot T} \right)}
\]

\[
C_{max} = \frac{100}{0.25 \cdot 60 \cdot 0.25 \cdot 0.5 \cdot \left(1 - e^{-0.25 \cdot 8} \right) \cdot \left(1 - e^{-0.25 \cdot 0.5} \right)}
\]

=7.44 (mg/L)

\[
C_{max}' = C_{max} \cdot e^{-kt} = 7.44 \cdot e^{-0.25 \cdot 0.5} =6.55 \text{ (mg/L)}
\]

\[
C_{min}' = C_{max} \cdot e^{-k(\tau - T - 0.5)} =7.44 \cdot e^{-0.25 \cdot (8-0.5-0.5)} =7.44 \cdot 0.17 =1.26 \text{ (mg/L)}
\]
5. Determine a regimen (dose and dosing interval) to treat a patient (CL=5 L/h, Vd=0.25 L/kg, 90 kg) that suffers from a pulmonary infection if the “true” peak and trough concentrations at steady state are supposed to be 25 mg/L and 5 mg/L, respectively. Assume a short-term infusion over 30 minutes.

First to calculate the dosing interval:

\[ V_d = 0.25 \times 90 = 22.5 \text{L} \]
\[ CL = 5 \text{L/h} \]
\[ K = \frac{CL}{V_d} = \frac{5}{22.5} = 0.22 \text{ (/h)} \]

\[ \tau = \frac{\ln\left(\frac{C_{\text{max}}}{C_{\text{min}}}\right)}{k} + T = \frac{\ln\left(\frac{25}{5}\right)}{0.22} + 0.5 = \frac{1.61}{0.22} + 0.5 = 7.32 + 0.5 \text{ (h)} \approx 8 \text{(h)} \]

\[ D = C_{\text{max(desired)}} \times k \times V_d \times T \times \frac{(1 - e^{-k \times \tau})}{(1 - e^{-k \times T})} \]

\[ = 25 \times 0.22 \times 22.5 \times 0.5 \times \frac{(1 - e^{-0.22 \times 8})}{(1 - e^{-0.22 \times 0.5})} \]

\[ = 25 \times 0.22 \times 22.5 \times 0.5 \times (0.83/0.10) = 513.6 \text{mg} \approx 500 \text{mg} \]

So the regimen will be 500 mg, Q8h.