1. A 50-year-old, 5'2'', 50 kg female with a serum creatinine of 2.0 mg/dL. She is given gentamicin for soft tissue infections. Calculate the gentamicin clinical peak concentration, i.e., 1 hour after initiating the one-half hour infusion of a 200 mg dose (using the short-term infusion model).

IBW = 45.5 + 2.3 • 2 = 50.1 kg

TBW < 120% IBW ⇒ use TBW

\[ CL_{cr} = \frac{(140 - \text{age}) \cdot \text{TBW}}{\text{Ccr} \cdot 85} = \frac{(140 - 50) \cdot 50}{2.0 \cdot 85} = 26.47 \text{mL/min} = 1.59 \text{L/hr} \]

Vd = 25% • TBW = 0.25 • 50 = 12.5 L


\[ k_e = \frac{CL}{V_d} = \frac{1.59 \text{L/hr}}{12.5 \text{L}} = 0.127 \text{hr}^{-1} \]

or by (Dettli): \( ke = 0.00293 \cdot CL_{cr} [\text{ml/min}] + 0.014 [/\text{hr}] = 0.09 / \text{hr} \)

\[ C_{\text{max}}^* = \frac{D}{CL \cdot T} (1 - e^{-keT}) \cdot e^{-keT} = \frac{200}{1.59 \cdot 0.5} (1 - e^{-0.127 \cdot 0.5}) \cdot e^{-0.127 \cdot 0.5} = 14.5 \text{mg/L} \]
2. A 43-year-old male, was admitted to the hospital following a car accident. He is 5’2” tall and on admission weighed 52 kg. He was taken for abdominal surgery and post-operatively became hypotensive and required large volumes of fluid to maintain his blood pressure. Currently, he weighs 65 kg and has a serum creatinine of 1.9 mg/dL. To receive gentamicin after his abdominal surgery:

a) Calculate the volume of distribution ($V_d$) and elimination half-life ($T_{1/2}$)

IBW = 50 + 2.3(2) = 54.6 kg > TBW ⇒ use TBW

$V_d = 0.25 \times 52 + (65 - 52) = 26 L$

$CL = CL_{cr} = \frac{(140 - 43) \times 52}{72 \times 1.9} = 36.9 \text{ mL/min} = 2.2 L/hr$

$ke = \frac{CL}{V_d} = \frac{2.2}{26} = 0.09/hr$

$T_{1/2} = 7.7 hr$

or by (Dettli): $ke = 0.00293 \times CLcr[ml/min] + 0.014[hr] = 0.12/hr$

$T_{1/2} = 5.7 hr$

In this case, Dettli equation is not recommended.

b) Calculate the dose and dosing interval if 10 mg/L (clinical peak) and 1 mg/L (clinical trough) of a half-hour infusion treatment are desired
\[\text{use } ke = \frac{CL}{Vd} = 0.09 / \text{hr}\]

\[\tau = \frac{\ln\left(\frac{C_{\text{max}}^*}{C_{\text{min}}^*}\right)}{ke} + T + t_{\text{max}}^* + t_{\text{min}}^* = 27 \text{ hr} \approx 24 \text{ hr}\]

**assume one-compartment:**

\[C_{\text{max}} = C_{\text{max}}^* \cdot e^{ke\cdot t_{\text{max}}^*} = 10.5 \text{mg} / \text{L}\]

\[D = C_{\text{max}} \cdot CL \cdot T \cdot \frac{(1 - e^{-ke\cdot T})}{(1 - e^{-ke\cdot T})} = 10.5 \cdot 2.2 \cdot 0.5 \cdot \frac{(1 - e^{-0.09 \cdot 24})}{(1 - e^{-0.09 \cdot 0.5})} = 232 \approx 230 \text{mg}\]
3. S.H. was given tobramycin 7 mg/kg QD in a 30-minute-infusion. Following the fifth dose of his regimen the following tobramycin concentrations were determined: 18 μg/mL (clinical peak) and 2 μg/mL (clinical trough). Based on the observations, make appropriate changes in this patient’s dosing regimen of tobramycin according to ODA nomogram below.

**ODA Nomogram for Gentamicin and Tobramycin at 7 mg/kg**

Measured levels are not on scale:

\[
ke = \frac{\ln\left(\frac{C_{\text{max}}^*}{C_{\text{min}}^*}\right)}{t} = \frac{\ln\left(\frac{18}{2}\right)}{22.5} = 0.10 \text{ / hr}
\]

\[
C_{11} = C_{\text{max}}^* \cdot e^{-ke\cdot10} = 18 \cdot e^{-0.1\cdot10} = 6.8 \text{ mg / L}
\]

⇒ 7 mg / kg q48h
4. A 65-year-old, 60 kg woman with a serum creatinine of 1 mg/dL, has been started on 1 g of vancomycin over 1 hour infusion q12h for the treatment of staphylococcal. Calculate initial peak and trough vancomycin concentration and steady-state peak and trough vancomycin concentration.

\[ V_d = 0.178 \cdot \text{age} + 0.22 \cdot \text{TBW} + 15 = 0.178 \cdot 65 + 0.22 \cdot 60 + 15 = 39.77 \text{L} \]

\[ \frac{CL_{cr}}{C_{p cr} \cdot 85} = \frac{(140 - \text{age}) \cdot \text{TBW}}{C_{p cr} \cdot 85} = \frac{(140 - 65) \cdot 60}{1 \cdot 85} = 52.94 \text{mL/min} = 3.18 \text{L/hr} \]

\[ k_e = \frac{CL}{V_d} = \frac{3.18 \text{ L/hr}}{39.77 \text{L}} = 0.08 \text{hr}^{-1} \]

Initial peak and trough

\[ C_{\text{max}_{1}} = \frac{D}{CL \cdot T} (1 - e^{-keT}) = \frac{1000}{3.18 \cdot 1} (1 - e^{-0.081}) = 24.18 \text{mg/L} \]

\[ C_{\text{min}_{1}} = C_{\text{max}} \cdot e^{-ke(\tau-T)} = 24.18 \cdot e^{-0.0811} = 10.03 \text{mg/L} \]

Steady state peak and trough

\[ C_{\text{max}_{ss}} = C_{\text{max}_{1}} \cdot \frac{1}{(1 - e^{-ke\tau})} = 39 \text{mg/L} \]

\[ C_{\text{min}_{ss}} = C_{\text{max}_{ss}} \cdot e^{-ke(\tau-T)} = 16 \text{mg/L} \]