Vancomycin Homework 2014

1. JC is an 80 yo, 80-kg, 173-cm man with *S. viridans* endocarditis. He is allergic to penicillins and cephalosporins. His SCr is 1.5 mg/dL and stable. Desired steady-state peak is 35mcg/ml; trough 15 mcg/ml.

* calculating an initial dose – use population parameters *

a. Compute a vancomycin dosing regimen for this patient.

① $CrCl = \frac{(140-80)(80)}{72 \times 1.5} = \boxed{44\ mL/min}$

④ $T = \frac{\ln(35\ mg/mL / 15\ mg/L)}{0.04/h} + 1h = 22.2h \Rightarrow \boxed{24h}$

$BMI = \frac{80\ kg}{(1.73m)^2} = 26.7\ kg/m^2 \Rightarrow$ pt NOT obese!

⑤ $k_0 = (0.04/h)(56L)(35\ mg/L) \times \frac{(1-e^{-0.04/h \times 24h})}{(1-e^{-0.04/h \times 1h})} = 1234\ mg/h \times 1h =$ 1234mg

② $k_e = 0.00083(44\ mL/min) + 0.0044 = \boxed{0.04/h}$

③ $V_D = \frac{0.7L}{kg} \times 80\ kg\ (TBW) = \boxed{56L}$

$\boxed{1250\ mg\ IV\ q\ 24h}$

b. Calculate a loading dose for this patient.

$LD = C_{max\ desired} \times V_D$

$= 35\ mg/L \times 56L = 1960\ mg \Rightarrow 2000\ mg$

$\boxed{LD = 2000\ mg\ IV}$

c. Estimate the predicted peak and trough that your regimen will provide.

① $C_p = \frac{\frac{1250\ mg}{h}}{(0.04/h)(56L)} \times \frac{(1-e^{-0.04/h \times 1h})}{(1-e^{-0.04/h \times 24h})} = \boxed{35.4\ mg/L}$

② $C_T = \frac{35.4\ mg}{L} \times (e^{-0.04/h(24h-1h)}) = \boxed{14.1\ mg/L}$

$\boxed{C_p = 35.4\ mg/L \quad C_T = 14.1\ mg/L}$

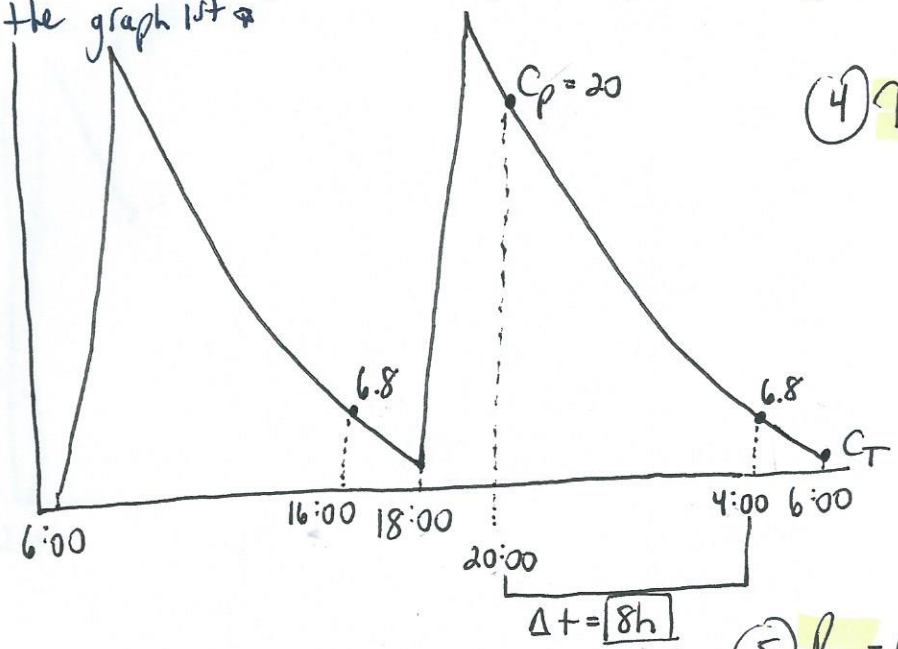
You have a measured peak + trough; so you can calculate pt-specific PK parameters!

2. TR is a 42 yo, 6'0", 285 lb male with *MRSA* cellulitis of the right lower leg. His SrCr is stable at 0.8 mg/dL. He is administered vancomycin 1000 mg IV every 12hrs, at 6:00 and 18:00 daily. Vancomycin serum concentrations were obtained after the fourth dose and are as follows: trough at 16:00 is 6.8 mg/L and peak at 20:00 is 20 mg/L. Desired steady-state peak is 30 mg/L; trough 13 mg/L.

↳ peak drawn at correct time!

a) Assess these concentrations and recommend a new vancomycin dosing regimen if necessary. Calculate the predicted peak and trough with your regimen.

* plot the graph 1st *



(4) $T = \frac{\ln(30\text{mg/L} / 13\text{mg/L})}{0.13/\text{h}} + 1\text{h} = 7.4\text{h} \approx$ **8h**

(1) $k_e = \frac{\ln(20\text{mg/L} / 6.8\text{mg/L})}{8\text{h}} =$ **0.13/h**

(5) $R_0 = (0.13/\text{h})(63.4\text{L})(30\text{mg/L}) \times \frac{(1 - e^{-0.13/\text{h} \times 8\text{h}})}{(1 - e^{-0.13/\text{h} \times 1\text{h}})}$

(2) Ext trough

$C_2 = C_1 \times e^{-k_{ext}}$

$C_T = 6.8\text{mg/L} \times e^{-0.13/\text{h} \times 2\text{h}}$

$C_T = 5.2$mg/L

Peak was drawn at correct time

$C_p = 20$mg/L

$R_0 = \frac{1311\text{mg}}{\text{h}} \times 1\text{h} = 1311\text{mg} \Rightarrow$ **1250mg**

*round vanco dose to nearest 250mg.

(6) $C_p = \frac{\frac{1250\text{mg}}{\text{h}}}{(0.13/\text{h})(63.4\text{L})} \times \frac{(1 - e^{-0.13/\text{h} \times 1\text{h}})}{(1 - e^{-0.13/\text{h} \times 8\text{h}})} =$

$C_p = 28.6$mg/L

1250mg IV q8h

$C_p = 28.6$mg/L $C_T = 11.5$mg/L.

(3) $V_D = \frac{\frac{1000\text{mg}}{\text{h}}}{0.13/\text{h}} \times \frac{(1 - e^{-0.13/\text{h} \times 1\text{h}})}{(20\text{mg/L} - 5.2\text{mg/L})}$

↑ extrapolated or true

↑ extrapolated or true trough.

$V_D = 63.4$L

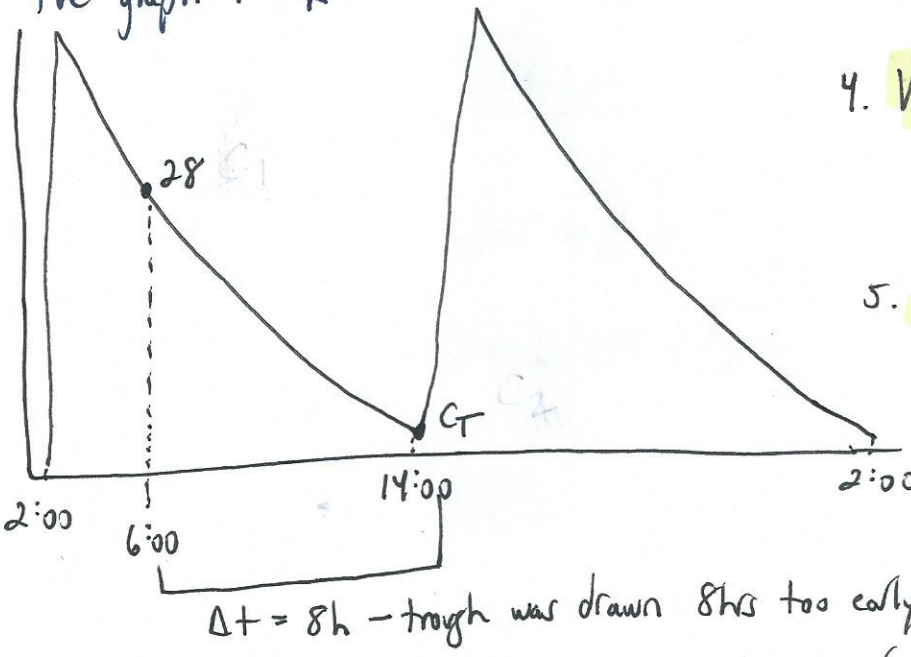
(7) $C_T = \frac{28.6\text{mg}}{\text{L}} \times e^{-0.13/\text{h}(8\text{h} - 1\text{h})}$

$C_T = 11.5$ mg/L ← acceptable

3. MP is a 92 yo, 4"11, 102 lb female currently being treated with vancomycin 1000 mg IV q12 for *MRSA* urosepsis. Her SrCr is stable at 0.8 mg/dL. Vancomycin is being administered at 14:00 and 2:00. Prior to the fifth dose of vancomycin, a measured trough at 6:00 is 28 mcg/mL. The goal vancomycin trough for this patient is 13 mcg/mL and goal vancomycin peak is 30 mcg/mL.

a) Assess the vancomycin trough and recommend a new dosing regimen if necessary. Calculate the predicted peak and trough with your regimen.

* plot the graph 1st *



* Only given the trough, so use population parameters... first must extrapolate the trough *

1. $CrCl = \frac{(140-92)(46.4)}{72 \times 0.8} \times 0.85 = \boxed{33\ mL/min}$

2. $k_e = 0.00083(33\ mL/min) + 0.0044 = \boxed{0.03/h}$

3. Ext Trough

$C_2 = C_1 \times e^{-k_e \times t}$

$C_T = 28\ mg/L \times e^{-0.03/h \times 8h}$

$\boxed{C_T = 22\ mg/L}$ → Too high! Need to recommend a new dose + interval.

4. $V_D = \frac{0.7L}{kg} \times 46.4kg = \boxed{32.5L}$ (TBW!)

5. $T = \frac{\ln(30\ mg/L / 13\ mg/L)}{0.03/h} + 1h =$

$28.9h \Rightarrow \boxed{24h}$

6. $R_0 = (0.03/h)(32.5L)(30\ mg/L) \times \frac{(1-e^{-0.03/h \times 24h})}{(1-e^{-0.03/h \times 1h})} =$

$R_0 = \frac{507\ mg}{h} \times 1h = 507\ mg \Rightarrow \boxed{500\ mg}$

7. $C_p = \frac{500\ mg}{(0.03/h)(32.5L)} \times \frac{(1-e^{-0.03/h \times 1h})}{(1-e^{-0.03/h \times 24h})}$

$\boxed{C_p = 29.5\ mg/L}$ 500 mg IV q24h.

$C_p = 29.5\ mg/L$ $C_T = 14.8\ mg/L$

8. $C_T = \frac{29.5\ mg}{L} \times (e^{-0.03/h(24h-1h)}$

$\boxed{C_T = 14.8\ mg/L}$