2.13. Vancomycin

Solutions

To view a video demonstrating solutions to a vancomycin problem, go to https://www.youtube.com/user/murphyassessment.

1. A. For vancomycin, ABW is used for V, thus 60 kg.

   Determine volume of distribution:

   V (L) = 0.62 L/kg × 60 kg = 37.2 L

   Estimate k by estimating vancomycin clearance (CL_{vanc}) from creatinine clearance.

   CL_{vanc} (mL/min) = [(0.689 × CrCl) + 3.66] = [(0.689 × 92) + 3.66]

   = 67.048 mL/min

   67.048 mL/min × 0.06 = 4.02 L/hr

   Since CL = k × V

   $$k = \frac{CL}{V}$$

   $$\text{Thus, } k\ (hr^{-1}) = \frac{4.02\ L/hr}{37.2\ L} = 0.108\ hr^{-1} \text{ and}$$

   $$t½ = \frac{0.693}{0.108\ hr^{-1}} = 6.40\ hr$$

   The calculations below use a dosing interval of 12 hours.
   Use the trough of 10 mg/L. The trough will occur 9.5 hours after the end of the 2-hour infusion.

   $$C = \left(\frac{S \times D}{k \times V \times t'}\right)\left(\frac{(1-e^{-kt'})}{(1-e^{-k\tau})}\right)\left(e^{-kT}\right)$$

   10 mg/L =

   $$\left(\frac{1 \times D}{0.108\ hr^{-1} \times 37.2\ L \times 2\ hr}\right)\left(\frac{\left(1-e^{-(0.108\ hr^{-1})(2\ hr)}\right)}{\left(1-e^{-(0.108\ hr^{-1})(12\ hr)}\right)}\right)\left(e^{-(0.108\ hr^{-1})(9.5\ hr)}\right)$$

   Dose = **836.6 mg**

1. (continued)

Because this dose is not one that would actually be used, round off to either 750 mg or 1000 mg every 12 hours. Changes in concentrations estimated will directly relate to changes in dose.

If the dose is increased to 1000 mg every 12 hours, the estimated trough would be:

Trough 10.0 mg/L × $\frac{1000\text{ mg}}{836.6\text{ mg}}$ = **12.0 mg/L**

B. Gentamicin is also a potential nephrotoxin and may increase the risk of nephrotoxicity with vancomycin. Creatinine might be monitored more frequently and perhaps lower vancomycin concentrations could be targeted. Also, monitor gentamicin concentrations.

C. In this case ABW/IBW = $\frac{80}{59.3}$ = 1.35.

Thus, she would be considered obese:

V in obese patients = 0.56 L/kg of ABW

V = 0.56 L/kg × ABW (80kg) = **44.8 L**

2. V = 80 kg × 0.62 L/kg = 49.6 L

CL_{vanc} (L/hr) = [0.711 × (CrCl) + 18.9] × 0.06

k = CL/V

t½ = 0.693/k

<u>0 mL/min:</u>

CL_{vanc} (L/hr) = [0.711 × (0) + 18.9] × 0.06

= 1.177 L/hr

k = $\frac{1.177\text{ L/hr}}{49.6\text{ L}}$ = 0.024 hr^{-1};

t½ = 0.693/0.024 hr^{-1} = **28.9 hr**

<u>40 mL/min:</u>

CL_{vanc} (L/hr) =

[0.711 × (40) + 18.9] × 0.06 = 2.840 L/hr

k = $\frac{2.840\text{ L/hr}}{49.6\text{ L}}$ = 0.057 hr^{-1}

t½ = 0.693/0.057 hr^{-1} = **12.2 hr**

<u>80 mL/min:</u>

CL_{vanc} (L/hr) =

[0.711 × (80) + 18.9] × 0.06 = 4.547 L/hr

k = $\frac{4.547\text{ L/hr}}{49.6\text{ L}}$ = 0.092 hr^{-1}

t½ = 0.693/0.092 hr^{-1} = **7.5 hr**

<u>120 mL/min:</u>

CL_{vanc} (L/hr) =

[0.711 × (120) + 18.9] × 0.06 = 6.253 L/hr

k = $\frac{6.253\text{ L/hr}}{49.6\text{ L}}$ = 0.126 hr^{-1}

t½ = 0.693/0.126 hr^{-1} = **5.5 hr**

CrCl	Half-Life
0	28.9
40	12.2
80	7.5
120	5.5

3. <u>CL predictor</u>:

CL (L/hr) =

W × [(0.028/Scr) + (0.000127 × Age) + (0.0123 × GA28)] + 0.006

CL (L/hr) =

6.1 kg × [(0.028/0.8) + (0.000127 × 0) + (0.0123 × 1)] + 0.006

CL (L/hr) = **0.295 L/hr**

4. A. Start by determining volume of distribution:

V (L) = 0.62 L/kg × 70 kg = 43.4 L

Next, determine the elimination rate constant (k) and half-life.

Estimate k from estimated vancomycin clearance and volume of distribution.

Cl_{vanc} = (0689 × CrCl) + 3.66 = 28.46 mL/min

28.46 mL/min × 0.06 = 1.708 L/hr

k (hr^{-1}) = CL/V = $\frac{1.708\text{ L/hr}}{43.4\text{ L}}$

= 0.039 hr^{-1}