PHA 5128 Dose Optimization II

Spring 2013 · Homework V

Due on Mar 1st, 10 points

If there are any questions please contact Luning Zhuang (adazhuang@ufl.edu)

Theophylline

1. C.C. is a 30 years old, 44 kg weight woman admitted to the ER for the exacerbation of her asthma caused by excessive exercise. (2 point each, 4 points)

(1) What is the IV loading dose of aminophylline for her to achieve plasma levels of 15 mg/L (Assume Vd=0.5 L/kg and S=0.80)?

$$Vd = 0.5 \times 44 = 22L$$

$$LD = \frac{Cp \times Vd}{F \times S} = \frac{15 \times 22}{1 \times 0.80} = 412.5mg$$

(2)What is the infusion rate of aminophylline required to maintain the plasma concentrations of theophylline at 15 mg/L, if CL=0.04 L/kg/hr?

$$CL = 0.04 \times 44 = 1.76\, L/h$$

$$MD = \frac{D}{\tau} = \frac{Css \times CL}{S \times F} = \frac{15 \times 1.76}{0.80 \times 1} = 33\, mg/h$$

Cyclosporine

2. A liver transplant patient at Shands hospital has been treated with IV infusion of 200 mg/day of cyclosporine for a certain time. His plasma concentration at steady state is 180 ng/mL. Since he is doing fine, the physician would like to change IV infusion to orally administration and decrease the desired steady state concentration by 10%. What is the reasonable dose for oral treatment? (The bioavailability of oral cyclosporine is 0.3)(1 points)

$$Dose_{new} = \frac{Css_{desired}}{Css_{Current}} \times \frac{F_{current}}{F_{new}} \times Dose_{current} = \frac{180 \times (1-10\%)}{180} \times \frac{1}{0.3} \times 200 = 600 mg/day$$

Lidocaine

3. H.C. is a 45 years old, 60 kg female with liver cirrhosis. On the sixth hospital day, she developed ventricular arrhythmias, and lidocaine was given. The first day of lidocaine administration, she received an initial 50 mg bolus dose of lidocaine at 9:00 am, followed by 100 mg infusion administered over the next 30 min. At 10:00 am, she was given 1.5 mg/min constant infusion of lidocaine . Predict her lidocaine concentration at the start of her maintenance infusion and at steady state. (Vc=0.61 L/kg, Vd=2.3 L/kg, CL=6 mL/kg/min, S=0.87) (3 points)

$$Vd = 2.3 \times 60 = 138L$$

(Using the final Vd because the plasma concentration we are going to calculate is 30 min after the end of the infusion. At that time we believe the distribution should be complete.)

$$CL = 6 \times 60 = 360\, mL/\min = 21.6\, L/h$$

$$k_e = \frac{CL}{Vd} = \frac{21.6}{138} = 0.157 h^{-1}$$

t_1=1h, t_2=0.5h

$$C_1 = \frac{S \times F \times Dose}{Vd} \times e^{-k_e t_1} + \frac{S \times F \times Dose}{CL \times T} \times (1 - e^{-k_e T}) \times e^{-k_e t_2}$$
$$= \frac{0.87 \times 1 \times 50}{138} \times e^{-0.157 \times 1} + \frac{0.87 \times 1 \times 100}{21.6 \times 0.5} \times (1 - e^{-0.157 \times 0.5}) \times e^{-0.157 \times 0.5} = 0.83\, mg/L$$

$$Css = \frac{Dose \times F \times S}{\tau \times CL} = \frac{(1.5 \times 60) \times 1 \times 0.87}{21.6} = 3.6\, mg/L$$

Procainamide

4. A.P. is a 40 years old, 65 kg weight woman. She was admitted to the hospital with a diagnosis of tachyarrhythmia. Her serum creatinine is 1.5 mg/dL. Calculate the maintenance infusion rate that will keep the average plasma concentration of procainamide at 5 mg/L. (S=0.87) (2 points)

$$CL_{cr} = \frac{(140 - age) \times BW}{Cp_{cr} \times 85} = \frac{(140 - 40) \times 65}{1.5 \times 85} = 51.0\, ml/\min = 3.1\, L/h$$

$$CL_{renal} = 3 \times CL_{cr} = 3 \times 3.1 = 9.3\, L/h$$

$$CL_{acetylation} = 0.13 \times BW = 0.13 \times 65 = 8.5\, L/h$$

$$CL_{other} = 0.1 \times BW = 0.1 \times 65 = 6.5\, L/h$$

$$CL_{total} = CL_{renal} + CL_{acetylation} + CL_{other} = 9.3 + 8.5 + 6.5 = 24.3\, L/h$$

$$MD = \frac{D}{\tau} = \frac{CL \times Css}{F \times S} = \frac{24.3 \times 5}{1 \times 0.87} \approx 140\, mg/h$$