Theophylline

1. H.Y. is a 25 years old, 50 kg woman receiving aminophylline with maintenance infusion rate of 20 mg/h (S=0.8). Her theophylline level is 12 mg/L. However, she needs to take ciprofloxacin at the same time (Factor=0.7). What is the maintenance infusion rate to keep the same theophylline level?

\[
CL_{old} = \frac{S \times F \times D}{CSS \times \tau} = \frac{0.8 \times 1 \times 20}{12} = 1.3 \text{ L/h}
\]

\[
CL_{new} = CL_{old} \times 0.7 = 1.3 \times 0.7 = 0.91 \text{ L/h}
\]

\[
MD = \frac{D}{\tau} = \frac{CL_{new} \times CSS}{S \times F} = \frac{0.91 \times 12}{0.8 \times 1} = 13.65 \text{ mg/h} \approx 14 \text{ mg/h}
\]
Cyclosporine

2. A 40 years old 70 kg weight patient received a kidney transplant and treated with cyclosporine tablet 200 mg TID (F=0.3). After achieving steady state, his “true” trough level is 60 ng/mL. If the desired peak and trough concentrations at steady state are 300 ng/mL and 100 ng/mL, what would be the new dosing regimen? (Vd=4.5L/kg) (Cyclosporine is rapidly absorbed)

\[ Vd = 4.5 \times 70 = 315L \]

\[ C_{\text{max}} = C_{\text{min}} + \frac{F \times D}{Vd} = 60 + \frac{0.3 \times 200}{315} \times 1000 = 250.5 \text{ng/mL} \]

\[ k_e = \frac{\ln C_1 - \ln C_2}{t_2 - t_1} = \frac{\ln 250.5 - \ln 60}{8} = 0.179 h^{-1} \]

\[ \tau = \frac{\ln C_1 - \ln C_2}{k_e} = \frac{\ln 300 - \ln 100}{0.179} \approx 6h \]

\[ Dose = \frac{C_{\text{max}} \times (1 - e^{-k_e \tau}) \times Vd}{F \times S} = \frac{300 \times (1 - e^{-0.179 \times 6}) \times 315 \times 1000}{0.3 \times 1} = 2.1 \times 10^8 \text{ng} = 210 \text{mg} \]

So the Dose regimen is 210 mg, q6h.
Lidocaine

3. P.C. is a 60 kg, 50 years old man with heart failure. Predict the loading IV dose of lidocaine to achieve the plasma level of 5 mg/L. \((V_c=0.3 \text{ L/kg}, V_d=0.88\text{L/kg}, S=0.87)\) Calculate the maintenance infusion rate of lidocaine to keep the concentration to 3 mg/L. \((CL=6 \text{ mL/kg/min})\)

\[ V_c = 0.3 \times 60 = 18 \text{ L} \]

We used the initial distribution because we are calculating the loading IV dose.

\[ LD = \frac{V_c \times C_p}{F \times S} = \frac{18 \times 5}{1 \times 0.87} = 103.4 \text{ mg} \]

\[ CL = 6 \times 60 = 360 \text{ mL/min} = 21.6 \text{ L/h} \]

\[ MD = \frac{D}{\tau} = \frac{C_{ss} \times CL}{S \times F} = \frac{3 \times 21.6}{0.87 \times 1} = 74.5 \text{ mg/h} \]
Procainamide

4. I.B. is a 50 years old, 75 kg male with serum creatinine of 1.2 mg/dL. He is treated with procainamide because of tachyarrhythmia. Calculate the half-life of procainamide in this patient. (Vd=2L/kg)

\[
CL_{cr} = \frac{(140 - \text{age}) \times BW}{Cp_{cr} \times 72} = \frac{(140 - 50) \times 75}{1.2 \times 72} = 78.1 \text{ml/min} = 4.7 \text{L/h}
\]

\[
CL_{renal} = 3 \times CL_{cr} = 3 \times 4.7 = 14.1 \text{L/h}
\]

\[
CL_{acetylation} = 0.13 \times BW = 0.13 \times 75 = 9.8 \text{L/h}
\]

\[
CL_{other} = 0.1 \times BW = 0.1 \times 75 = 7.5 \text{L/h}
\]

\[
CL_{total} = CL_{renal} + CL_{acetylation} + CL_{other} = 14.1 + 9.8 + 7.5 = 31.4 \text{L/h}
\]

\[
Vd = 2 \times 75 = 150 \text{L}
\]

\[
k_e = \frac{CL}{Vd} = \frac{31.4}{150} = 0.209 \text{h}^{-1}
\]

\[
t_{1/2} = \frac{0.693}{k_e} = \frac{0.693}{0.209} = 3.3 \text{h}
\]