



Homework 2

Bio pharmaceuticals & Pharmacokinetics/PHAR434

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Notice: Please solve the following case (use clear handwriting, take a photo or scan it and upload on ITC)

A new antibiotic drug was given in a single intravenous bolus of 4 mg/kg to 5 healthy male adults ranging in age from 23 to 38 years (average weight 75 kg). The pharmacokinetics of the plasma drug concentration–time curve for this drug fits a one-compartment model. The equation of the curve that best fits the data is:

Determine the following (assume units of mcg/mL for C_p and hours for t):

- What is the $t_{1/2}$?
- What is the V_D ?
- What is the plasma level of the drug after 4 hours?
- How much drug is left in the body after 4 hours?
- Predict what body water compartment this drug might occupy and explain why you made this prediction.
- Assuming the drug is no longer effective when levels decline to less than 2 mcg/mL, when should you administer the next dose?

$$C_p = 78e^{-0.46t}$$

* Answers:-

a) $C_p = 78 \cdot e^{-0.46t}$ $C_p = C_p^0 \cdot e^{-kt}$

$k = 0.46 \text{ h}^{-1}$

$t_{1/2} = \frac{0.693}{k} \rightarrow \frac{0.693}{0.46 \text{ h}^{-1}} \Rightarrow 1.5 \text{ h}$

$t_{1/2} = 1.5 \text{ h}$

b) Dose = 4 mg/kg * 75 kg
I.V bolus Average weight

Dose = 300 mg

$V_D = \frac{D}{C_p} \rightarrow \frac{300 \text{ mg} \times 1000}{78 \text{ mg/ml}} \rightarrow 3846 \text{ ml} = 3.8 \text{ L}$

$V_D = 3.8 \text{ L}$

c) $C_p^4 = 78 \cdot e^{-0.46 \times 4}$

$= 78 \cdot e^{-1.84} \rightarrow 78 \cdot 0.1588$

$C_p = 12.4 \text{ mg/ml at } t = 4 \text{ h}$

d) $D_B = C_p^4 \times V_D \rightarrow 12.4 \text{ mg/ml} \times 3846 \text{ ml}$

$D_B = 4769 \text{ mg} \Rightarrow 4.7 \text{ mg at } t = 4 \text{ h}$

①

e) Average weight = 75 kg

$V_D = 3.8 \text{ L} = 3.8 \text{ kg}$ because 70% of body is water or blood

% body wt = $\frac{3.8 \text{ kg}}{75 \text{ kg}} \times 100\%$

$\% \text{ BW} = 5.1\%$

V_D convert to kg because its equal or approx. to plasma volume (70% H₂O)

f) We need to find the time (t).

$C_p^t = C_p^0 \cdot e^{-0.46t}$

$2 \text{ mg/ml} = 78 \cdot e^{-0.46t}$ (X log)

$\log 2 = \log 78 + \frac{-0.46t}{2.3}$

$0.3 = 1.9 - 0.2t$

$0.2t = 1.9 - 0.3 \rightarrow t = 8 \text{ h}$

$t = 8 \text{ h}$