

Case Study
Vancomycin
PHA 4120

The antibiotic Vancomycin is eliminated almost entirely by glomerular filtration. For a patient with normal renal function, the half-life is about 6 hours. The volume of distribution is 0.9 L/kg. For systemic infections, vancomycin is given intravenously and shows a pronounced distribution phase (with a duration of up to one hour) after administration. Vancomycin is usually given via short term infusions (1 hr) with a dosing interval of either 6 or 12 hours. Although, like many other antibiotics, vancomycin has a wide therapeutic margin, the desired steady-state concentrations are 20 mg/L (1 hr post-infusion) and 5-10 mg/L at the end of the dosing interval.

A 43 year old patient (70 kg) develops a wound infection (found to be *Staphylococcus aureus*). Since this bacteria is resistant to penicillins, the patient is begun on vancomycin. Answer the following questions concerning dosage regimens for this patient.

Questions

1) If vancomycin is given as an i.v. bolus, which equation will best describe the concentration-time profile? Do we have sufficient information (given above) to apply equations to this form?

2) Calculate an appropriate loading dose for this patient using both the i.v. bolus and short-term infusion equations. Compare the results. Are they significantly different? Explain.

3) Using a dosing interval of 12 hrs, determine a dosing regimen for this patient. How many doses are required to reach steady-state levels? What are the peak (clearly indicate what "peak" refers to) and trough values at steady-state?

4) Consider the fact that this patient's creatinine clearance is only 30 ml/min and the dosing regimen is 500 mg every 12 hrs. What are the peak and trough values at steady-state? The elimination rate constant may be calculated using the empirically derived equation:

$k = (0.0083 \text{ hr}^{-1}) \times (\text{Creatinine Cl}) + 0.0044$
which has units of hr^{-1} .

5) If the actual peak and trough values are 23 mg/L and 14 mg/L (giving 500 mg every 12 hrs), what are k and V_d for this patient? Suggest a new dosing regimen (dose and dosing interval) to provide peak and trough values of 25 mg/L and 7 mg/L respectively.

These questions are based on those found in Case Studies 9-12 in the white book.