

# Deacon's Challenge

## No 142 - Answer

A 24-year old man weighing 70 kg is admitted following ingestion of ethylene glycol. Calculate the volume of ethanol (10% w/v infusion) required to achieve a plasma ethanol concentration of 11 mmol/L, and the infusion rate required to maintain this once achieved. Assume the rate of elimination of ethanol follows zero-order kinetics with a rate of 2.2 mmol/L/h. FRCPath, Spring 2012

First convert the concentration of the ethanol infusion from % (i.e. g/100 mL) to mmol/L:

$$\text{Ethanol (mmol/L)} = \frac{\text{Ethanol (g/100 mL)} \times 10 \times 1,000}{\text{MW ethanol}}$$

$$\text{MW ethanol (C}_2\text{H}_5\text{OH} = \text{C}_2\text{H}_6\text{O)} = (2 \times 12) + (6 \times 1) + 16 = 46$$

$$\text{Ethanol (mmol/L)} = \frac{10 \times 10 \times 1,000}{46} = 2174 \text{ mmol/L}$$

Absorbed ethanol is distributed throughout total body water (i.e. between all fluid compartments). Therefore the volume of distribution ( $V_d$ ) is equal to total body water. Assuming an average body water content of 60% (quoted in most textbooks although a value of 68% may be more accurate) the  $V_d$  for this patient can be calculated:

$$\begin{aligned} V_d \text{ (L)} &= \text{Body wt (Kg)} \times 60/100 \\ &= 70 \times 0.6 \\ &= 42 \text{ L} \end{aligned}$$

Next calculate the total amount of ethanol required to achieve 42 L of 11 mmol/L:

$$\begin{aligned} \text{Total ethanol (mmol)} &= \text{Plasma ethanol (mmol/L)} \times V_d \text{ (L)} \\ &= 11 \times 42 \\ &= 462 \text{ mmol} \end{aligned}$$

Finally calculate the volume of the infusion solution which will contain 462 mmol ethanol:

$$\begin{aligned} \text{Vol of infusion solution (L)} &= \frac{\text{Total ethanol required (mmol)}}{\text{Ethanol concentration in infusion solution (mmol/L)}} \\ &= \frac{462}{2174} \\ &= 0.213 \text{ L (213 mL)} \end{aligned}$$

To calculate the infusion rate needed to maintain a steady state concentration of 11 mmol/L:

In a steady state:

$$\text{Rate of infusion (mmol/h)} = \text{Rate of elimination (mmol/h)}$$

ACB News | Issue 599 | March 2013

$$\begin{aligned} \text{Rate of infusion (mmol/h)} &= \text{Rate of fluid infusion (L/h)} \times \text{Fluid ethanol concentration (mmol/L)} \\ &= \text{Rate of fluid infusion (L/h)} \times 2174 \\ \text{Rate of elimination (mmol/h)} &= \text{Rate of elimination (mmol/L/h)} \times V_d \text{ (L)} \\ &= 2.2 \times 42 \end{aligned}$$

Therefore in a steady state:

$$\begin{aligned} \text{Rate of fluid infusion (L/h)} \times 2174 &= 2.2 \times 42 \\ \text{Rate of infusion} &= \frac{2.2 \times 42}{2174} = 0.0425 \text{ L/h (} = 42.5 \text{ mL/h)} \end{aligned}$$

## Question 143

The distribution of genotypes seen in Chemist's Disease is as shown. Calculate the frequency of the two alleles CCR-5 and ccr-5, and state whether these frequencies accord with the Hardy-Weinberg equilibrium.

Genotype	Number of individuals
CCR-5/CCR-5	568
CCR-5/ccr-5	134
ccr-5/ccr-5	2
Total	704

FRCPath, Spring 2012

### Pathology harmony

working to harmonise standards in UK pathology

## Haemoglobin Harmony... Are You Ready?

If you have not changed to g/L for haemoglobin and MCHC you need to plan now for the 31 March 2013 implementation deadline!

Key boxes for you to tick:

- ☒ Date for change to g/L agreed
- ☒ Clinical Governance issues addressed
- ☒ IT changes all in place
- ☒ Help from equipment suppliers
- ☒ POCT – Change in units same day to minimise clinical risks

Further details available at [pathologyharmony.co.uk](http://pathologyharmony.co.uk)

The Association for Clinical Biochemistry  
[www.acb.org.uk](http://www.acb.org.uk)

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