Deacon's Challenge No. 48 Answer

Calculate the least significant difference for a change in cholesterol if the intra-individual coefficient of variation for cholesterol is 4.7% and the analytical coefficient of variation is 2.4%.

A patient was changed from Atorvastatin 80 mg to Rosuvastatin 40 mg and the total cholesterol fell from 6.9 to 5.9 mmol/L.

Calculate the percentage change in cholesterol and state whether this is significant.

MRCPath, November 2004

First calculate the total coefficient of variation.

$$CV_t^2 = CV_a^2 + CV_i^2$$

Where CVt = total coefficient of variation = ?
CVa = analytical coefficient of variation = 2.4 %
CVi = intra-individual coefficient of variation = 4.7 %

So that $CV_t^2 = 2.4^2 + 4.7^2$
$= 5.76 + 22.09 = 27.85$
and $CV_t = \sqrt{27.85} = 5.28\%$

For two results to be significantly different (at $p<0.05$) they have to be at least 2.8 SDs apart.
(*The derivation of this can be found on p105 of Clinical Investigation and Statistics in Laboratory Medicine by Richard Jones and Brian Payne, Venture Publications 1997*).

Similarly, if a result is expressed as a percentage change from the initial value, then this percentage change has to be greater than 2.8 CVs to be significant.

Therefore the least significant difference is

$$2.8 \times CV_t\,(\%) = 2.8 \times 5.28 = \mathbf{14.8\%}$$

$$\text{Percentage change} = \frac{\{\text{Initial chol (mmol/L)} - \text{Final chol (mmol/L)}\} \times 100}{\text{Initial chol (mmol/L)}}$$

$$= \frac{(6.9 - 5.9) \times 100}{6.9} = \mathbf{14.5\%}$$

Since this percentage change is not greater than 14.8%, the change is **not** quite statistically significant at the 5% level of probability. ■

Question 49

A 45-year old man is brought to casualty following a fit. He had been working alone late in a garage, when he was found by the security guard who called an ambulance. On admission, he has a large bruise on the left temple and is semi-comatose, he smells of alcohol. The admitting team request urea and electrolytes, glucose and an alcohol and blood gas estimation and arrange an urgent CT scan. The results are as follows:

Sodium	141 mmol/L	Potassium	4.5 mmol/L
Urea	3.5 mmol/l	Creatinine	105 µmol/L
Ethanol	270 mg/dL	Glucose	3.2 mmol/L
Hydrogen ion	39 nmol/L	PO_2	11.6 kPa
PCO_2	3.8 kPa		

The CT scan does not show any bony injury or evidence of intracranial bleed. The neurological registrar is called and asks for an osmolal gap to help provide a quick estimation of whether there is a possibility that other toxic substances present in the garage, such as antifreeze, have been taken in any quantity.

The measured osmolality is 330 mOsm/Kg.

As Duty Biochemist you are asked to:

a) Calculate the osmolal gap.

b) Show whether the alcohol concentration explains the observed osmolal gap, explaining any assumptions you make in the process.

MRCPath, May 2000