Deacon's Challenge No. 77 Answer

In order to evaluate the recovery of a renal tubular protein in an immunoassay, 500 µL of a normal urine containing the protein at 310 pg/mL was spiked with 50 µL of protein standard, 2000 pg/mL. The measured protein concentration in the mixture was 430 pg/mL. Calculate the recovery.

MRCPath, May 2006

The recovery of the protein standard added (the "spike") to the normal urine (the "base material") is the percentage of the amount added which is measured in the assay:

$$\text{Recovery (\%)} = \frac{\text{Amount measured} \times 100\%}{\text{Amount added}}$$

This simple concept is complicated by the base material containing a measurable amount of the protein for which the recovery is being measured and the dilution of the concentrations of the protein in both materials which occurs when they are mixed.

Therefore the concentrations need to be corrected as follows:

Concentration of protein from base material (normal urine):

500 µL normal urine (containing 310 pg/mL) is mixed with 50 µL protein standard
i.e. diluted to 500 + 50 = 550 µL.

$$\text{Concentration of protein from normal urine} = \frac{\text{Initial concentration} \times \text{Initial volume}}{\text{Final volume}}$$

$$= \frac{310 \times 500}{550} = 282 \text{ pg/mL (3 sig figs)}$$

Concentration of protein from protein standard:

50 µL protein standard (containing 2000 pg/mL) is mixed with 500 µL of normal urine
i.e. diluted to 50 + 500 = 550 µL.

$$\text{Concentration of protein from protein standard} = \frac{2000 \times 50}{550} = 182 \text{ pg/mL (3 sig figs)}$$

Therefore when the concentration of protein in the normal urine (initially 282 pg/mL) is increased by 182 pg/mL due to the addition of the protein standard, the measured concentration is 430 pg/mL. The calculation of recovery is therefore as follows:

$$\text{Recovery (\%)} = \frac{(\text{Measured concentration} - \text{Concentration from normal urine}) \times 100}{\text{Concentration from added standard}}$$

$$\text{Recovery (\%)} = \frac{(430 - 282) \times 100}{182} = \mathbf{81\%} \text{ (2 sig figs)}$$

Question 78

A patient is found to have a serum digoxin concentration of 3.5 µg/L. Digoxin was stopped. Assuming a half life of digoxin in the serum of 40 hours, how long would it take for the serum digoxin concentration to fall to 2.0 µg/L?

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