Deacon's Challenge No. 55 Answer

The upper limit of the reference range for mercury excretion in urine in occupationally exposed workers is given as: 10 µg Hg/g creatinine.

Express this as nmol Hg/mmol creatinine.

(Atomic weight mercury 200.6, molecular weight creatinine 113.1).

MRCPath, May 2005

The general expression relating weights in mass units to SI units is:

$$\text{Weight (mol)} = \frac{\text{Weight (g)}}{\text{Atomic or Molecular weight}}$$

It is simplest to consider concentrations of mercury and creatinine in turn.

Mercury is expressed as µg and we wish to convert it to nmol. Division of mercury in µg by its atomic weight (200.6) will give mercury in µmol. Since there are 1000 nmol in each µmol, this value must be multiplied by 1000.

Therefore for mercury:

$$\text{Mercury (nmol)} = \frac{\text{Mercury (µg)} \times 1000}{200.6}$$

Creatinine is expressed as g/L and we wish to convert it to mmol. Division of creatinine in g by its molecular weight (113.1) will give creatinine in mol. Since there are 1000 mmol in each mol, this value must be multiplied by 1000.

Therefore for creatinine:

$$\text{Creatinine (mmol)} = \frac{\text{Creatinine (g)} \times 1000}{113.1}$$

These two expressions are combined in order to convert the mercury:creatinine ratio from µg/g to nmol/mmol:

$$\text{Mercury:creatinine (nmol/mmol)} = \frac{\text{Mercury (µg)} \times 1000 \times 113.1}{\text{Creatinine (g)} \times 1000 \times 200.6}$$

Note that since creatinine appears in the denominator its molecular weight appears in the numerator (since mercury concentration is divided by creatinine concentration). The 1000s cancel and substituting the mercury creatinine ratio in µg/g gives:

Mercury:creatinine (nmol/mmol) =

$$\frac{10 \times 113.1}{200.6} = 5.6 \text{ nmol/mmol (2 sig figs)}$$

Question 56

Calculate the loading dose of digoxin (bioavailability 0.75, salt factor = 1) required to achieve an initial plasma concentration of 1.5 µg/L in a 60 kg man (assume volume of distribution = 7 L/Kg):

a) If the patient has never taken digoxin
b) If the patient is currently on digoxin with a plasma concentration of 0.5 µg/L