# Deacon's Challenge No. Answer 47

A specimen of spinal fluid from a patient who had suffered head trauma was noted to be bloodstained. The CSF protein was found to be 1183 mg/L on clear colourless supernatant after centrifuging (no scan done). The CSF contained red cells 10,200 cells per cubic millimeter.

As the diagnosis was not clear, the doctors looking after the patient wondered how much of the CSF protein may have come from the traumatic tap. On the same day, the patient's serum total protein was 73 g/L, and the RBC from the full blood count was $4.5 \times 10^{12}$ cells/L.

Estimate the percentage of the measured CSF protein that may have come from the serum.

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When blood leaks into CSF, the proportion of red cells and protein added to the CSF remains constant. This is regardless of whether the blood in the CSF arises by trauma during collection or from a subaracchnoid haemorrhage. i.e.

$$\frac{\text{Red cell count in CSF}}{\text{Red cell count in blood}} = \frac{\text{Protein concentration in CSF arising from blood}}{\text{Protein concentration in blood}}$$

It is important that the units used should be the same for blood and CSF. Converting the units in CSF to those used for blood:

$1L = 1000\ cm^3 = (10\ cm)^3 = (100\ mm)^3 = 1{,}000{,}000\ mm^3 = 1.0 \times 10^6\ mm^3$

Therefore CSF red cell count $= 10{,}200\ cells/mm^3 = 1.02 \times 10^4\ cells/mm^3$

$= 1.02 \times 10^4 \times 1.0 \times 10^6 = 1.02 \times 10^{10}\ cells/L$

(Note that when multiplying numbers that are in exponential form, the exponents are added, not multiplied)





For CSF protein concentration:

$1g = 1000\ mg$, therefore $1\ mg = 0.001\ g$

so that $1183\ mg/L = \frac{1183}{1000}\ g/L = 1.183\ g/L$

Substituting these values into the equation relating CSF and blood ratios:

$$\frac{1.02 \times 10^{10}}{4.05 \times 10^{12}} = \frac{\text{CSF protein derived from blood}}{73}$$

$$\text{CSF protein derived from blood} = \frac{73 \times 1.02 \times 10^{10}}{4.05 \times 10^{12}}$$

$$= \frac{73 \times 1.02}{4.05 \times 10^2} = \frac{74.46}{405} = 0.184\ g/L$$

$$\%\ \text{CSF protein derived from blood} = \frac{\text{CSF protein derived from blood (g/L)} \times 100}{\text{Measured CSF protein (g/L)}}$$

$$= \frac{0.184 \times 100}{1.183} = 15.55\ \%\ (16\%\ \text{to 2 sig figs})$$

## Question 48

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, 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.

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