Deacon's Challenge

No 117 - Answer

A 75-year old patient had a convulsion four days after a partial hip replacement. She is found to have a serum sodium concentration of 108 mmol/L. Her estimated weight is 55 kg. Estimate the volume of 2.7% saline required to increase her serum sodium concentration to 125 mmol/L. State clearly any assumptions you make. (Atomic weights of sodium 23, chlorine 35.5).

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First calculate the Na concentration (in mmol/L) in 2.7% saline:

MW NaCl = 23 + 35.5 = 58.5

2.7% NaCl = 2.7 g/100 mL = 27 g/L = 27,000 mg/L

$$\text{Concn (mmol/L)} = \frac{\text{Concn mg/L}}{\text{MW}} = \frac{27{,}000}{58.5} = 462 \text{ mmol/L}$$

Next calculate the amount (in mmol) of Na required to correct the plasma sodium. Assume:

- Patient is fully hydrated without water excess
- The defect is simple Na depletion
- Hyponatraemia is NOT due to SIADH – otherwise inappropriate natriuresis will occur and administered Na will not be retained
- All administered Na remains in the ECF
- The water in the saline solution is excreted so does not affect ECF volume

Assume normal body water content of 55% (for a female) and that a third of this is in the ECF. Therefore for a body weight of 55 Kg:

$$\text{ECF vol} = 55 \times \frac{55}{100} \times \frac{1}{3} = 10.1 \text{ L}$$

Target rise in plasma Na concn = 125 - 108 = 17 mmol/L

Total Na required = Target rise (mmol/L) x ECF vol (L)

= 17 x 10.1 = 172 mmol

Finally, calculate the volume of 2.7 % NaCl required:

$$\text{Vol 2.7 \% NaCl} = \frac{\text{Total Na required (mmol)}}{\text{Na concn in 2.7 \% NaCl (mmol/L)}}$$

$$= \frac{172}{462} = \textbf{0.37 L} \text{ or } 370 \text{ mL (2 sig figs)}$$

Question 118

Your laboratory has recently changed assays for HDL cholesterol. A bias study established that the relationship between the new assay (y) and the old assay (x) is described by the formula y = 1.07x + 0.06. Given between-day imprecisions of 2.3% for the new assay and 2.8% for the old assay, and assuming a within-subject biological variation of 7%, determine whether an apparent increase in a patient's HDL from 0.8 to 1.0 mmol/L following the method change represents a true increase.

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