Deacon's Challenge

No 124 - Answer

A man admitted with nausea and confusion was found to have a serum sodium concentration of 107 mmol/L. Calculate the volume of 1.8% sodium chloride anticipated to raise his serum sodium to 125 mmol/L, and the rate of infusion expected to achieve a rate of increase of 0.5 mmol/hour (atomic masses: Na 23, Cl 35.5).

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Assume the following:

- Pure Na loss has occurred i.e. patient is fully hydrated.
- All the administered Na remains in the ECF i.e. no redistribution or loss by renal (or other) routes.
- The patient has an idealised body weight of 70 kg with ECF vol of 14 L.
- The administered fluid does not increase ECF volume (i.e. is excreted in the urine).

Target Na change = 125 - 107 = 18 mmol/L

Total Na needed = 18 x ECF vol = 18 x 14 = 252 mmol

Calculate concentration of 1.8 % NaCl in mmol/L:

MW NaCl = 23 + 35.5 = 58.5

1.8% = 1.8g/100 mL = 18 g/L = 18,000 mg/L

$$\text{Concn (mmol/L)} = \frac{\text{Concn (mg/L)}}{\text{MW}} = \frac{18{,}000}{58.5} = 308 \text{ mmol/L}$$

$$\text{Vol 1.8\% NaCl needed} = \frac{\text{Total Na needed}}{\text{Fluid NaCl (mmol/L)}} = \frac{252}{308} = 0.818 \text{ L (approx 820 mL)}$$

Since administration of all of the 818 mL would increase plasma ECF Na by 18 mmol/L

Administration of $\frac{818 \text{ mL}}{18}$ would raise ECF Na by 1 mmol/L

and administration of $\frac{818 \times 0.5}{18}$ = 22.7 mL would raise ECF Na by 0.5 mmol/L

Therefore required infusion rate = **22.7 mL/h (approx 23 mL/h)**

Question 125

Calculate the range for the 95% confidence limits of a plasma osmolarity calculated using the following formula:

$$\underset{\text{mmol/Kg}}{\text{Osmolarity}} = \underset{\text{mmol/L}}{1.86[Na^+]} + \underset{\text{mmol/L}}{[\text{glucose}]} + \underset{\text{mmol/L}}{[\text{urea}]} + 9$$

if the analytical standard deviations are: Na^+ 0.8 mmol/L, glucose 0.2 mmol/L and urea 0.25 mmol/L.