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Acid-Base Balance-Electrolyte Quiz – Case 58

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Which is the change of osmolality and extracellular and intracellular volume after the rapid administration of 3 L of hypotonic (N/2) saline solution in a man with Posm 300 mosmoL/kg and body weight 80 kg?

Answer:

The initial number of total body osmoles is total body water (60%×body weight=48 L)×Posm=14,400.

The administration of 3 L of hypotonic (N/2) saline solution is associated with the addition of approximately 150×3=450 osmoles. Thus, the new total number of osmoles is 14,850, while the new total body water is 48 L+3 L=51 L. Therefore, the new Posm is: $\frac{14,850}{51L}$ = 291 mosmoL/kg (hence, a decrease in Posm and subsequently in serum sodium is expected). The new total number of osmoles in the extracellular volume (baseline value 48 L/3=16 L) is 16 L×300 mosmoL/kg+450=5,250. Thus, the new extracellular volume is:

$$\frac{\text{New osmoles}}{\text{New Posm}} = \frac{5.250}{291} = 18 \text{ L (an increase by 2 L)}$$

Accordingly the new intracellular volume is:

$$\frac{\text{New osmoles}}{\text{New Posm}} = \frac{32 \text{ L} \times 300}{291} \frac{9,600}{291} = 33 \text{ L (an increase by 1 L)}.$$

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