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Acid-Base Balance-Electrolyte Quiz – Case 60

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Which is the effect on Posm, as well as on both extracellular and intracellular volume after the administration of 3 L of water (f.e. dextrose solution 5%)? Posm is 300 mosmoL/kg and body weight is 80 kg.

Answer

No change in the number of total body osmoles is observed: (300 mosmoL/kg ×48 L=14,400). However, the total body water is increased by 3 L (to 51 L). Thus, the new Posm is reduced: 14,400/51=282 mosmoL/kg (a decrease in Posm and subsequently in serum sodium is expected). Furthermore, the new extracellular volume is:

$$\frac{\text{New osmoles in extracellular fluid}}{\text{New Posm}} = \frac{\text{Baseline osmoles in extracellular fluid}}{\text{New Posm}} = \frac{16\ \text{L}\times 300}{282} = \frac{4{,}800}{282} = 17\ \text{L (a small increase by 1 L will be observed)}$$

Accordingly, an increase of intracellular volume by 2 L will be noticed. In accordance with these calculations, the infusion of 3 L of isotonic saline solution could lead to an increase of extracellular volume by 3 L, with no change in osmolality and intravascular volume.

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