

Understanding Hyponatremia

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Key Words

Hyponatremia · Hyponatremia · Sodium and water balance

Abstract

Understanding hyponatremia is at times difficult for many clinicians. However, hyponatremia can often be deciphered easily with some basic understanding of water and sodium balance. Here, the basic pathophysiological abnormalities underlying the development of sodium disorders are reviewed, and case examples are given. Hyponatremia often arises in the hospital, especially in the intensive care units due to the combination of (1) not being able to drink water; (2) inability to concentrate the urine (most often from having kidney failure); (3) osmotic diuresis from having high serum urea concentrations, and (4) large urine or stool outputs.

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Why Are Serum Sodium Concentration Problems Difficult?

Hyponatremia and hyponatremia are commonly encountered problems both in the outpatient setting and especially in hospitalized patients. Frequently, confusion arises as to how best manage these patients with serum sodium concentration abnormalities. In the case of hy-

ponatremia not only how much fluid to give is questioned but also what kind of fluid. With hyponatremia, the problem is usually figuring out what has led to the abnormal serum sodium concentration. In order to undo some of this confusion, one first needs to understand why sodium concentration problems are so difficult.

Sodium concentration problems are difficult because as far as sodium is concerned the body is comprised of at least two compartments (the extracellular and the intracellular fluid). If one imagines a one-compartment system where sodium concentration is same in the total body water, sodium concentration problems would be simple (fig. 1). In a one-compartment system, the serum sodium concentration is equal to total body sodium divided by total body water.

$$[Na] = \text{total body Na} / \text{total body water (in a one-compartment system)}$$

Imagining this one-compartment system, if the serum sodium concentration is for example 160 mEq/l and total body water is 40 liter, one can easily see that administering 5.7 liter of pure water will lower the serum sodium concentration to 140 mEq/l (assuming that there is no sodium or water loss, and no sodium intake). Again, in a one-compartment system if one starts out with a serum sodium concentration of 140 mEq/l (total body water 40 liter), makes 2 liter of urine with sodium concentration of 40 mEq/l in 24 h, and has no intake, then the serum so-

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