Hyponatremia

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Introduction: Serum sodium concentration and serum osmolarity normally are maintained under precise control by homeostatic mechanisms involving stimulation of thirst, secretion of antidiuretic hormone (ADH), and renal handling of filtered sodium. Clinically significant hyponatremia is relatively uncommon and is nonspecific in its presentation; therefore, the physician must consider the diagnosis in patients presenting with vague constitutional symptoms or with altered level of consciousness. A thorough understanding of the pathophysiology of hyponatremia is a must to initiate safe and effective corrective therapy. The patient’s fluid status must be accurately assessed upon presentation, as it guides the approach to correction.

QUESTIONS:

1. What is the normal range of sodium in adults?
   a. 138-148 mEq/L
   b. 133-143 mEq/L
   c. 135-145 mEq/L
   d. 145-150 mEq/L

2. What is the lowest acceptable limit of sodium below which you will embark upon correction?
   a. 120 mEq/L
   b. 100 mEq/L
   c. 150 mEq/L

3. What are the most likely causes of hyponatremia?
   a. Diarrhea
   b. GI fistulas
   c. Salt-wasting nephropathy
   d. Cerebral salt-wasting syndrome
   e. Psychogenic polydipsia
   c. All of the above

4. What are the common signs of hyponatremia?
   a. Cognitive impairment
   b. Focal or generalized seizure activity
   c. Coma
   d. Decorticate or decerebrate posturing
   e. Sudden severe hypertension

5. What is the normal range of sodium in adults?
   f. All of the above

6. Hyponatremia has the most pronounced effects on;
   a. Nerve excitation
   b. Neuromuscular junction transmission
   c. Cardiac muscle fibre contractility
   d. Brain synapse function
   e. Cellular volume

7. What are the common complications of hyponatremia?
   a. Rhabdomyolysis
   b. Seizures
   c. Permanent neurologic sequelae
   d. Respiratory arrest
   e. All of the above
   f. None of the above

8. In what concentration you will give saline solution to correct severe hyponatremia?
   a. 3% Hypertonic saline
   b. 1% Hypertonic saline
   c. 5% Hypertonic saline
   d. 1.8% Hypertonic saline

9. How will you calculate the amount of hypertonic saline to be infused?

10. How will you monitor the optimum correction of hyponatremia?
Answers:

1. C

2. a. The ultimate danger for these patients is brainstem herniation when sodium levels fall below 120 mEq/L. Hence, the therapeutic goal is to increase the serum sodium level rapidly by 4-6 mEq/L over the first 1-2 hours.

3. e. all of the above; Common causes include excess fluid losses (e.g., vomiting, diarrhea, excessive sweating, GI fistulas or drainage tubes, pancreatitis, burns) that have been replaced primarily by hypotonic fluids, acute or chronic renal insufficiency, in which the patient may be unable to excrete adequate amounts of free water, salt-wasting nephropathy, cerebral salt-wasting syndrome seen in patients with traumatic brain injury, aneurysmal subarachnoid hemorrhage, and intracranial surgery. It may also be seen in psychogenic polydipsia, often in psychiatric patients. Administration of hypotonic intravenous or irrigation fluids and SIADH. Systemic diseases associated with hyponatremia include acute or chronic renal failure, hepatic cirrhosis, congestive heart failure, or nephrotic syndrome, uncorrected hypothyroidism or cortisol deficiency (adrenal insufficiency, hypopituitarism). Hyponatremia can be caused by many medications. Known offenders include acetazolamide, amiloride, amphotericin, thiazide diuretics, amiodarone, basiliximab, angiotensin II receptor blockers, angiotensin-converting enzyme inhibitors, bromocriptine, carbamazepine, celecoxib and cyclophosphamide etc.

4. f. All of the above: Most abnormal findings on physical examination are characteristically neurologic in origin, including altered level of alertness to coma, variable degrees of cognitive impairment (e.g., difficulty with short-term recall; loss of orientation to person, place, or time; frank confusion or depression), focal or generalized seizure activity. In those patients with acute severe hyponatremia, signs of brainstem herniation, including coma; fixed, unilateral, dilated pupil; decorticate or decerebrate posturing; sudden severe hypertension and respiratory arrest.

In addition to neurologic findings, patients may exhibit signs of hypovolemia or hypervolemia.

5. d &e. Most abnormal findings on physical examination are characteristically neurologic in origin (see 4 above). Cellular brain edema is the main cause of the development of the signs and symptoms of hyponatremia.

6. e. All of the above

7. a. 3% hypertonic saline

8. Sodium Requirement (mEq) = TBW (Desired Na - Serum Na) where TBW = Body Weight X 0.6 Volume of Hypertonic Saline = Na Requirement (mEq) X 1000 / Infusate Na Concentration (mEq/L)/.

For example, a 60-kg woman with serum sodium level of 113 mEq/L would require 280 mL of hypertonic saline in order to increase serum sodium by 4 mEq/L (could be administered as 140 mL/h for 2 h). In general, 200-400 mL of 3% NaCl is reasonable dose in most adult patients with severe symptomatic hyponatremia. Give IV over first 1-2 h until resolution of seizures or herniation.

9. Symptomatic relief and serial serum sodium level measurements.

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