Hyponatremia (<135 mEq/L)

Hyponatremia is the most common electrolyte abnormality encountered in clinical practice, approximately 15-30% of hospitalized patients are hyponatremic.\(^1\)\(^2\)

Clinical Manifestations of Hyponatremia

The major manifestations of hyponatremia are mainly neurologic in origin and related to the acute brain swelling or cerebral edema.

Signs and symptoms of cerebral edema

- Visual changes
- Focal neurologic changes
- Encephalopathy

*These are dependent on the patients underlying risk factors, as well as the severity AND duration of the hyponatremic episode

Risk Factors for Cerebral Edema

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Pathophysiologic Mechanism</th>
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<tbody>
<tr>
<td>Children (under age 16)</td>
<td>Higher brain-to-intracranial volume ratio</td>
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<td>Women (especially premenopausal)</td>
<td>Sex steroids (estrogeic) inhibit brain adaptation</td>
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<td>Increased vasopressin levels</td>
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<td>Cerebral vasoconstriction and hypoperfusion of brain tissue</td>
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<tr>
<td>Hyponatemia</td>
<td>Impaired brain adaptation</td>
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<tr>
<td>Ecstasy use</td>
<td>Inappropriate antidiuretic hormone secretion</td>
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Range of Possible Symptoms Based on Sodium Level

**Chronic mild hyponatremia (125-135 mEq/L)**

- Asymptomatic
- Impairment of attention, posture, and gait
- Increased risk of falls

**Moderate (115-125 mEq/L) to Severe (<110-115 mEq/L) hyponatremia**

- Signs and symptoms of brain swelling
- Early symptoms are nausea and malaise
- Symptoms may progress to headache, lethargy, and obtundation

Duration of Development of Hyponatremia

- Acute <48hrs
- Chronic >48hrs OR Unknown

Osmotic Demyelination Syndrome

- Confusion
- Horizontal gaze paralysis
- Spastic quadriplegia (increased limb tone, limb weakness, hyperactive reflexes, Babinski’s sign)
- Pseudobulbar palsy (head and neck weakness, dysphagia, dysarthria)
- Delirium
- Coma
- Locked-in-syndrome (vertical eye movements, blinking, breathing, and alertness may remain intact)
- Death

Appropriate Rate of Correction\(^3\)

- Treat until serious symptoms resolve
- Do not correct greater than 6-8 mEq/L in a 24hr period in patients at high risk for demyelination (this is not a goal but a recommended maximum limit)
- Do not correct greater than 10-12 mEq/L in a 24hr period in chronic hyponatremic patients

**MONITOR Na LEVELS EVERY 2-4HRS DURING CORRECTION

Symptomatic Hyponatremia Treatment\(^4\)**

Hyponatremic patients with neurologic disease (seizure disorders) of the brain or those with severe symptoms represent a true medical emergency. Rapid correct of the serum sodium level is needed to prevent the worsening of cerebral edema and reverse complications of hyponatremic encephalopathy.

This is best accomplished by a continuous infusion of 3% saline. Recommended infusion rate for 3% saline infusion in patients with serious signs or symptoms

- 1 mL/kg/hr for the first several hours

This is will usually raise the sodium level by 1 mEq/L/hr

Recommended rate of 3% saline infusion in patients displaying signs of active brain herniation or in patients with seizures

- 2-3 mL/kg/hr over the first few hours then decrease to 1 mL/hr

It should be noted that no studies have actively compared the safety and efficacy of these approaches. The 3% NaCl should be discontinued as soon as symptoms resolve.

Asymptomatic Hyponatremia Treatment

**Normovolemic Hypotonic Hyponatremia**

- Fluid restriction
- Daily restriction of fluid intake to less than 1 to 1.2L is enough to allow the serum sodium level to increase in most patients.
- Identify and correct underlying causes
- Increased solute intake
- Vasopressin antagonists

**Hypervolemic Hypotonic Hyponatremia**

- Fluid restriction down to 1 - 1.2 L per day is needed
- Goal is to achieve a negative water balance and correct the serum sodium level to a concentration greater than 125 mEq/L.
- Treat underlying cause
  - CHF
  - Nephrotic syndrome
  - Loop Diuretic
  - Vasopressin antagonists

**Hypovolemic Hypotonic Hyponatremia**

- Correct fluid depletion with 0.9% NaCl
- Carefully monitor patients for overcorrection, due to rapid sodium changes when diuresis occurs

Hyponatremia References

2. Upadhyay A, Jaber BL, Madias NE. Incidence and

Patients at High Risk for Developing Demyelination Syndrome

- Hypokalemic patients
- Elderly women
- Alcoholics
- Malnourished patients