Hypernatremia : Causes, Signs and Symptoms, Treatment

Hypernatremia is defined as a **serum sodium concentration >145 mmol/L**. It represents a **hyperosmolar state** typically due to **a net water deficit relative to sodium content**, rather than excessive sodium accumulation.

> ? **Key Concept:** Hypernatremia is fundamentally a **“water problem”**, not a sodium excess issue.

Classification

- **Acute Hypernatremia**: Develops in **<24 hours.**
- **Chronic Hypernatremia**: Persists for **>48 hours**.
  - *Correction must be cautious in chronic cases to avoid cerebral edema.*

Etiology (Causes of Hypernatremia)

1. Water Losses

- **Insensible Losses** (Extrarenal):
  - Excessive **sweating**, **burns**, **fever**, **tachypnea**, respiratory infections.
- **Gastrointestinal Losses**:
- **Vomiting**, **infectious diarrhea**, **nasogastric suctioning.**
- **Transcellular Shifts**:
  - Conditions like **rhabdomyolysis** or **seizures** can shift water into cells, concentrating extracellular sodium.

2. Renal Losses

- **Diabetes Insipidus (DI)**:
- **Central DI**: Deficient ADH (vasopressin) secretion.
  - Causes: **Trauma**, **neurosurgery**, **tumors**, **infections**, **hypoxic brain injury**, **granulomatous disease.**
- **Nephrogenic DI**: Renal unresponsiveness to ADH.
  - Causes: **Chronic kidney disease**, **hypercalcemia**, **hypokalemia**, **sickle cell disease**, **lithium**, **demeclocycline.**

3. **Osmotic Diuresis**:
   - Seen in **DKA**, **hyperosmolar hyperglycemic state (HHS)**, **mannitol use**, **glycosuria**, **urea.**

Clinical Presentation

Neurologic Symptoms

- Result from **cellular dehydration in the CNS**.
- Common signs and symptoms:
  - **Lethargy**, **weakness**
  - **Irritability**, **confusion**
  - **Seizures**, **coma** (especially if Na+ >160 mmol/L)

?? **High-Risk Group**: Elderly patients and those with impaired thirst or access to fluids.

Diabetes Insipidus Clue

- Patients with DI may report **polyuria (3–20 L/day)** and **polydipsia**.
- Urine is markedly **dilute** despite hypernatremia.

Diagnosis

Laboratory Evaluation

- **Serum Sodium**: >145 mmol/L
- **Serum Osmolality**: Elevated
- **Urine Osmolality**: Helps differentiate etiology:
  - **Low (<300 mOsm/kg)**: Suggests DI or primary polydipsia
  - **High (>600 mOsm/kg)**: Suggests extrarenal losses
- **Urine Sodium and Potassium**
- **Glucose, Urea, Creatinine**
- **24-hour urine volume**
- **Plasma Arginine Vasopressin (AVP)** or **copeptin levels** (if available)
- **Desmopressin (DDAVP) Test**: Differentiates between Central and Nephrogenic DI

Management

General Principles

- **Correct underlying cause**
- **Gradual correction** of sodium to avoid cerebral edema
  - **Acute hypernatremia**: Can correct faster (up to **1–2 mEq/L per hour** in symptomatic cases)
  - **Chronic hypernatremia**: Correct no more than **0.5 mEq/L per hour** or **12 mEq/L per 24 hours**

Fluid Replacement

- **Initial resuscitation** (if hypovolemic): Use **isotonic fluids (0.9% saline)**
- **Free water replacement**: Use **5% dextrose (D5W)** or **hypotonic saline (0.45%)**
- **Oral rehydration** if mild and patient can drink

Specific Treatments

Central Diabetes Insipidus (CDI)

- **Desmopressin (DDAVP)**: Intranasal, subcutaneous, IV, or IM
- **Monitor sodium and fluid balance carefully**

Nephrogenic Diabetes Insipidus (NDI)

- **Address underlying cause** (e.g., stop lithium)
- **Low-sodium diet**
- **Thiazide diuretics** (reduce polyuria via volume contraction)
- **NSAIDs (e.g., indomethacin)**: Reduce prostaglandin-mediated inhibition of ADH

Complications

- **Cerebral edema** (from overly rapid correction)
- **Seizures**, **permanent neurologic damage**
- **Coma** if untreated severe hypernatremia

HIGH YIELD

- **Hypernatremia = water deficit**, not sodium excess.
- Always assess **volume status** first.
- **Desmopressin test** distinguishes CDI from NDI.
- **Correct sodium slowly** in chronic cases to avoid brain swelling.
- **Elderly and neurologically impaired patients** are at highest risk.

Mnemonic: "MODEL" for Hypernatremia Causes

Medications/Meals (high sodium)
Osmotic diuretics
Diabetes insipidus
Excessive water loss
Low water intake