

Hyponatremia

Key concepts

- definition: serum $[Na^+] < 135 \text{ mEq/L}$.

Common etiologies:

- SIADH: **hypotonic hyponatremia** (effective serum osmol $< 275 \text{ mOsm/L}$) within appropriately high urinary concentration (urine osmol $> 100 \text{ mOsm/L}$) and **euvolemia** or **hypervolemia**.
- Cerebral salt wasting (CSW): similar to SIADH but with extracellular fluid volume depletion due to renal sodium loss (urinary $Na > 20 \text{ mEq/L}$).
- minimum W/U: serum $[Na^+]$, serum osmolality, urine osmolality, clinical assessment of volume status. If volume status is high or low: urinary $[Na^+]$ TSH (to R/O hypothyroidism).
- treatment: based on acuity, severity, symptoms & etiology; as appropriate.
- risk of overly rapid correction: osmotic demyelination (including central pontine myelinolysis).

Definition

Hyponatremia, is low **sodium** concentration in the blood, the most common **electrolyte** abnormality in clinical medicine ¹⁾.

Generally defined as a serum sodium level of less than 135 mEq/L and is considered severe when the serum sodium level is below 125 mEq/L .

Other forms of hyponatremia

1. isotonic hyponatremia (effective serum osmolality: $275\text{--}295 \text{ mOsm/kg}$):
 - a) pseudohyponatremia: an artifact of indirect lab techniques. Unusually high levels of lipids (e.g., **hypertriglyceridemia**) or proteins (e.g., **immunoglobulins** as can occur in **multiple myeloma**) reduce the aqueous fraction of **plasma** and produce artifactually low **sodium** lab values. This error does not occur with direct measurement methods
 - b) nonconductive irrigants, e.g., as used in cystoscopy to allow coagulation, when large volumes are inadvertently absorbed through a severed vein ("TURP syndrome")

Classification and Differential diagnosis

$[Na^+] < 135 \text{ mEq/L}$ = mild, < 130 = moderate, < 125 = severe hyponatremia.

Syndrome of inappropriate antidiuretic hormone secretion is the most common type of hyponatremia (dilutional hyponatremia) ²⁾.

Cerebral salt wasting syndrome.

Diagnosis

Work-up requires assessment of:

1. serum sodium: must be <135 mEq/L to qualify as hyponatremia.
1. urine osmolality: values >100 mOsm/kg are inappropriately high if serum tonicity is <275 mOsm/kg
2. volume status: differentiates SIADH from CSW
 - a) clinical assessment: better for hypervolemia (edema, upward trend in patient weights) but is insensitive in identifying extracellular fluid depletion as an etiology of hyponatremia⁸ (look for dry mucous membranes, loss of skin turgor, orthostatic hypotension)
 - b) normal saline infusion test used in uncertain cases. If the baseline urine osmolality is <500 mOsm/kg, it is usually safe to infuse 2 L of 0.9% saline over 24–48 hours. Correction of the hyponatremia suggests extracellular fluid volume depletion was the cause
 - c) central venous pressure (CVP) may be used: CVP <5 – 6 cm H₂O suggests hypovolemia in patients with normal cardiac function
3. check urinary $[Na^+]$ if volume status is high or low
4. determine duration of hyponatremia:
 - a) duration documented as <48 hours is considered acute
 - b) hyponatremia of >48 hours duration or of unknown duration is chronic
 - c) hyponatremia that occurs outside the hospital is usually chronic and asymptomatic except in marathoners and MDMA (“ecstasy”) drug users

Etiology

[Hyponatremia Etiology](#)

Clinical features

Due to slow compensatory mechanisms in the brain, a gradual decline in serum sodium is better tolerated than a rapid drop. Symptoms of mild ($[Na^+] < 130$ mEq/L) or gradual hyponatremia include: [anorexia](#), [headache](#), difficulty concentrating, [irritability](#), [dysgeusia](#) and muscle [weakness](#). Severe hyponatremia (<125 mEq/L) or a rapid drop (>0.5 mEq/hr) can cause neuromuscular excitability,

cerebral edema, muscle twitching and cramps, nausea/vomiting, confusion, seizures, respiratory arrest and possibly permanent neurologic injury, coma or death.

Data suggest that acute mild hyponatremia is associated with a reduction in bone formation activity³⁾.

¹⁾
Thompson CJ. Hyponatraemia: new associations and new treatments. European journal of endocrinology / European Federation of Endocrine Societies. 2010;162 Suppl 1:S1-3.

²⁾
Ellison DH, Berl T. Clinical practice. The syndrome of inappropriate antidiuresis. N Engl J Med. 2007 May 17;356(20):2064-72. Review. PubMed PMID: 17507705.

³⁾
Garrahy A, Galloway I, Hannon AM, Dineen R, Javadpour M, Tormey WP, Gan KJ, Twomey PJ, Mc Kenna MJ, Kilbane M, Crowley RK, Sherlock M, Thompson CJ. The effects of acute hyponatraemia on bone turnover in patients with subarachnoid haemorrhage; a preliminary report. Clin Endocrinol (Oxf). 2020 Nov 11. doi: 10.1111/cen.14367. Epub ahead of print. PMID: 33176010.

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Last update: **2024/06/07 02:57**

