Hyponatremia

Na^+ < 135 · Symptoms first, then tonicity, then volume

≤ 8 mEq / 24 h
the correction ceiling

STEP 1 · ARE THERE SEVERE SYMPTOMS *this overrides all workup*

SEVERE — TREAT NOW

Seizure, coma, obtundation, respiratory arrest. 3% saline 100 mL IV over 10 min, repeat up to **2 more times** until symptoms resolve. Goal is a **rapid rise of 4–6 mEq/L**, which is enough to reverse cerebral edema. You do not need the full workup first.

MILD / MODERATE

Nausea, headache, confusion, unsteadiness. Work through the diagnosis before treating, and correct slowly. **Chronic asymptomatic hyponatremia is not an emergency** — the danger is in correcting it fast.

THEN CHECK TONICITY

Measure **serum osmolality**. **Normal or high** means **pseudohyponatremia** (severe hyperlipidemia, paraproteinemia) or **translocational**: hyperglycemia, or **mannitol** given for raised ICP, cerebral edema, glaucoma, or as irrigant. Mannitol patients are **hypertonic — no hypertonic saline**.

STEP 2 · VOLUME STATUS + TWO URINE TESTS *this is the whole diagnostic algorithm*

Volume	Urine studies	Cause & treatment
Hypovolemic	Urine Na **< 20** mEq/L	**Extrarenal loss** — vomiting, diarrhea, third-spacing, poor intake. **Treat with isotonic saline**; the sodium corrects as ADH switches off.
Hypovolemic	Urine Na **> 20** mEq/L	**Renal loss** — diuretics (especially thiazides), adrenal insufficiency, cerebral salt wasting, salt-wasting nephropathy.
Euvolemic	Urine osm **> 100**, urine Na > 30	**SIADH** — malignancy, pneumonia, CNS disease, drugs (SSRIs, carbamazepine, cyclophosphamide). Exclude **hypothyroidism and cortisol deficiency** first.
Euvolemic	Urine osm **< 100**	**Primary polydipsia**, beer potomania, or low solute intake. The kidney is diluting appropriately; restrict water.
Hypervolemic	Urine Na < 20 (usually)	**Heart failure, cirrhosis, nephrotic syndrome** — effective arterial volume is low despite total overload. **Treat the disease, restrict water, use loop diuretics.** Saline makes it worse.

STEP 3 · CORRECT SAFELY *the ceiling matters more than the target*

1. **Do not exceed 8 mEq/L in any 24-hour period** in patients at risk of osmotic demyelination. The minimum useful daily correction is **4–6 mEq/L** — so the therapeutic window is narrow, and faster is not better.
2. **Overcorrection usually happens by accident**, when the underlying stimulus resolves and the kidney suddenly dumps free water.
3. **High ODS risk: Na^+ ≤ 105, alcohol use disorder, hypokalemia, malnutrition**, or **advanced liver disease**. In these patients stay at the low end of the range.
4. **Replace potassium at the same time.** Giving K^+ raises the sodium too, and unaccounted-for potassium repletion is a classic cause of inadvertent overcorrection.
5. **Overcorrecting?** Stop hypertonic saline, give **free water as D5W**, and add **desmopressin** to re-establish water retention. Co-administering desmopressin proactively is one of the best ways to prevent overly rapid correction in high-risk patients.

TREATING SIADH *the water is the problem, not the salt*

FIRST LINE

Fluid restriction plus increased solute intake is the most effective therapy — oral **urea** or salt tablets alongside restriction. Restriction alone frequently fails because it is hard to sustain and slow to work.

IF THAT FAILS

Loop diuretic with salt tablets, or a **vasopressin receptor antagonist** (tolvaptan) with close monitoring, since it can overcorrect. **Avoid saline in SIADH** — the kidney excretes the salt and retains the water, so the sodium can fall further.

DRUGS & SCENARIOS *the causes you will actually meet on the wards*

Scenario	What is happening, and what to do
Thiazide-induced	Impairs urinary **dilution** while thirst persists. Classically an older woman within weeks of starting. **Stop the thiazide** — and it may recur on rechallenge, so record it as an intolerance.
Drug-induced SIADH	**SSRIs** and venlafaxine, **carbamazepine** and oxcarbazepine, cyclophosphamide, vincristine, antipsychotics, NSAIDs, and **MDMA**. Review every new medication started in the preceding month.
Post-operative	Pain, nausea, and opioids all drive ADH, and hypotonic maintenance fluid then supplies the water. **Use isotonic maintenance fluid** in surgical patients — this is a preventable iatrogenic cause.
Post-TURP / hysteroscopy	Absorbed hypotonic **glycine or sorbitol irrigant** during monopolar **transurethral resection of the prostate**. Suspect it on **hypertension with bradycardia**, the reverse of the usual intraoperative crash. Glycine also gives **transient blindness** and hyperammonemia. **Bipolar uses saline and avoids it.**
Beer potomania / low solute	High fluid, minimal solute intake, so there is nothing to excrete the water with. **High ODS risk** from coexisting alcohol use, malnutrition, and hypokalemia. **Sodium can rise dangerously fast once nutrition starts.**
Exercise-associated	Endurance athlete who drank large volumes of hypotonic fluid. Can cause fatal cerebral edema with a modest number. **Treat with hypertonic saline, never with more water.**
Adrenal insufficiency	Hyponatremia **with hyperkalemia** and hypotension. Check a cortisol before labelling it SIADH — the treatment is completely different.

MONITORING WHILE YOU CORRECT *write these into the plan explicitly*

THE ORDER SET

Sodium every 2–4 h while on hypertonic saline, then 6-hourly. **Strict input and output** — a sudden large dilute urine output is the warning sign of imminent overcorrection. Check **potassium, magnesium, and glucose** alongside.

THE HANDOVER

State the **starting sodium, the target for the next 24 h, and the maximum permitted**. Overcorrection almost always happens across a shift change, when the underlying stimulus resolves overnight and nobody has written down the ceiling.

PEARLS & PITFALLS

- **Thiazides, not loops, are the classic diuretic cause** — loops impair concentrating ability, thiazides impair dilution.
- In severe symptomatic disease, **bolus 3% saline is safer than an infusion** — you get the rapid 4–6 mEq rise you need without drifting past the ceiling.

References: European Clinical Practice Guideline on Hyponatremia · US/Irish expert panel recommendations on hyponatremia · CJASN 2024 review on hyponatremia treatment targets.