

● FLUID & ELECTROLYTE IMBALANCES · NCLEX 2026

Hyponatremia & Hypernatremia

Sodium (Na^+) is the main extracellular cation — it controls water distribution, nerve impulse conduction, and fluid balance. Where sodium goes, water follows. Imbalances create immediate **neurologic emergencies** because the brain is most sensitive to osmotic shifts.

HYPONATREMIA

< 135 mEq/L

Water overload → cells swell

NORMAL Na^+

135 – 145 mEq/L

Isotonic balance

HYPERNATREMIA

> 145 mEq/L

Water deficit → cells shrink

01 Definition & Overview

FOUNDATIONS

LOW SODIUM

Hyponatremia

Serum sodium **below 135 mEq/L**. Too much water relative to sodium — the blood is *diluted*. Water shifts **into cells**, causing them to swell. Brain cells are most affected → cerebral edema.

WHY IT MATTERS

- Brain swelling → seizures, coma, death
- Most common electrolyte imbalance in hospitalized clients
- Older adults are at highest risk

HIGH SODIUM

Hypernatremia

Serum sodium **above 145 mEq/L**. Too little water relative to sodium — the blood is *concentrated*. Water shifts **out of cells**, causing them to shrink. Brain cells shrivel → risk of intracranial bleeding.

WHY IT MATTERS

- Brain shrinkage → tearing of bridging veins, bleeding
- Most often caused by water loss, not sodium excess
- High mortality in frail or confused clients

02 Pathophysiology — Simplified

WATER FOLLOWS SODIUM

Hyponatremia Pathway

"Dilution → cells soak up water"

1 Cause: Excess water intake, SIADH, thiazide diuretics, D5W infusion, V/D, Addison's, heart failure, cirrhosis



2 Serum becomes **hypotonic** (too much water, not enough solute)



3 Water shifts from **extracellular** → **intracellular** space



4 Cells **SWELL** — especially brain cells



5 Cerebral edema → headache, confusion, seizures, coma

Hypernatremia Pathway

"Concentration → cells give up water"

1 Cause: Dehydration, diabetes insipidus, fever, hyperventilation, burns, DKA, tube feedings w/o water, hypertonic saline



2 Serum becomes **hypertonic** (not enough water relative to sodium)



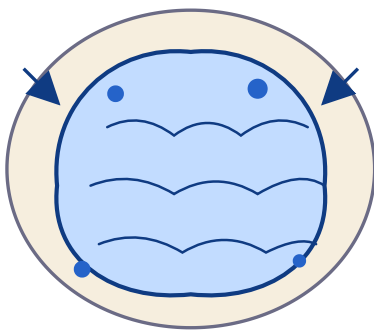
3 Water shifts from **intracellular** → **extracellular** space



4 Cells **SHRINK** — brain cells pull away from the skull

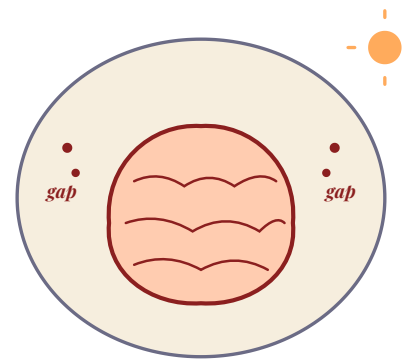


5 Intracranial bleeding risk → restlessness, seizures, coma



Brain SWELLS in Hyponatremia

Water moves INTO brain cells → cerebral edema



Brain SHRINKS in Hypernatremia

Water moves OUT of brain cells → risk of bleeding

03 Causes at a Glance

RECOGNIZE THE SETUP

Category	Hyponatremia (<135)	Hypernatremia (>145)
Fluid	Water overload · D5W infusion · hypotonic IVs · psychogenic polydipsia	Dehydration · NPO · inadequate water intake · tube feeds w/o water flushes
GI Losses	Vomiting · diarrhea · NG suction · GI fistulas	Watery diarrhea (infant) · severe vomiting with no replacement
Hormonal	SIADH · Addison's disease (adrenal insufficiency)	Diabetes insipidus (DI) · hyperaldosteronism · Cushing's
Medications	Thiazide diuretics · SSRIs · oxytocin · desmopressin	Hypertonic saline (3%) · sodium bicarb · corticosteroids
Chronic Disease	Heart failure · cirrhosis · kidney failure	Uncontrolled DM · DKA · chronic kidney disease
Other	Low-sodium diet · beer potomania · SSRIs	Fever · hyperventilation · burns · heatstroke

04 Signs & Symptoms

NEURO IS PRIORITY

Hyponatremia — Brain Swells

Think *"overwatered plant"* — cells are waterlogged, sluggish, weak.

EARLY / MILD

Headache
Nausea, vomiting
Muscle cramps, weakness
Fatigue, lethargy
Anorexia
Orthostatic hypotension

LATE / SEVERE

Confusion, disorientation
 Seizures
 Coma
Hyporeflexia (↓ DTRs)
Cerebral edema
Respiratory arrest



$\text{Na}^+ < 120 \text{ mEq/L}$ = SEIZURE & DEATH RISK. Institute seizure precautions immediately.

Hypernatremia — Brain Shrinks

Think *"raisin in the sun"* — cells are parched, irritated, on fire.

EARLY / MILD

Intense thirst
Dry, sticky mucous membranes
Flushed skin, low-grade fever
Restlessness, irritability
Oliguria (dark, concentrated urine)
Weakness

LATE / SEVERE

Agitation → confusion
 Twitching, hyperreflexia
 Seizures, coma
Swollen, red tongue
Hypertension → hypotension
Intracranial hemorrhage



$\text{Na}^+ > 160 \text{ mEq/L}$ = HIGH MORTALITY. Expect severe neuro deterioration; correct SLOWLY.

05 Priority Nursing Interventions

ABCS · SAFETY · NEURO

Hyponatremia Management

Goal: raise Na^+ slowly and restore cellular balance.

Assess	Neuro status (LOC, reflexes), vital signs, lung sounds, I&O, daily weight — same scale, same time.
Restrict	Free water (especially in SIADH/dilutional) — typically 800–1,000 mL/day per HCP order.
Administer	IV 0.9% NS for most cases. Severe symptomatic: IV 3% hypertonic saline via central line + pump.
Monitor	Serum Na^+ q2–4h during correction. Raise no more than 8–12 mEq/L in 24 hr .
Protect	Seizure precautions: bed low, rails padded, suction/ O_2 at bedside, airway kit ready.
Hold	Thiazide diuretics, SSRIs, desmopressin as ordered. Treat the underlying cause.
Encourage	Dietary sodium if safely able (not in SIADH) — broth, salted foods, processed items.

Hypernatremia Management

Goal: replace water deficit slowly to avoid brain cell overshoot.

Assess	Neuro status, thirst, mucous membranes, skin turgor, weight, urine specific gravity, I&O.
Administer	IV hypotonic fluids — 0.45% NS or D5W as ordered. Always infuse via pump.
Encourage	Oral water intake when able. Offer fluids every 1–2 hours for alert clients.
Monitor	Serum Na^+ q4–6h. Lower no more than 8–12 mEq/L in 24 hr to prevent cerebral edema.
Protect	Seizure precautions. Frequent neuro checks, especially during correction phase.
Flush	Tube feedings: free water flushes before/after feedings and q4h to prevent dehydration.
Limit	Dietary sodium — read food labels; avoid processed foods and added salt.

06 Pharmacology

KEY AGENTS

HYPERTONIC IV · FOR SEVERE
HYPONATREMIA

3% Sodium Chloride

Rapidly pulls water from brain cells back into vasculature. Raises serum sodium quickly.

Nursing: Central line preferred. Pump required. Hourly Na⁺ draws. Raise < 12 mEq/L per 24h. Watch for fluid overload (crackles, JVD).

ADH ANTAGONIST · "VAPTANS"

Tolvaptan / Conivaptan

Blocks ADH (vasopressin) receptors → the kidneys excrete free water, retaining sodium.

Nursing: Used for SIADH-related hyponatremia. Do NOT restrict fluids while on tolvaptan. Monitor LFTs. Expect increased urine output.

LOOP DIURETIC

Furosemide (Lasix)

Excretes water > sodium. Used in hypervolemic hyponatremia (HF, cirrhosis) to reduce fluid overload.

Nursing: Monitor K⁺ (hypokalemia risk), BP, orthostatic changes, daily weight. IV push slowly.

HYPOTONIC IV · FOR HYPERNATREMIA

0.45% NS / D5W

Provides free water to shift into cells → dilutes serum sodium.

Nursing: Pump required. Correct slowly. Monitor for cerebral edema (↑ headache, vomiting, seizures). Neuro checks q1–2h.

ADH REPLACEMENT · FOR DI

Desmopressin (DDAVP)

Synthetic ADH — promotes water reabsorption in the kidneys to treat central diabetes insipidus.

Nursing: Watch for water intoxication (hyponatremia!). Monitor Na⁺, I&O, daily weight. Intranasal or IV.

HOLD / CONTRIBUTORS

Meds to Review

Thiazides, SSRIs, desmopressin → can cause hyponatremia. Corticosteroids, Na-bicarb, hypertonic saline → can cause hypernatremia.

Nursing: Reconcile all meds. Notify HCP of Na⁺ abnormalities; hold suspected offenders per orders.

07 Complications

WHAT CAN GO WRONG

Hyponatremia Complications

Cerebral Edema

Brain swelling within the rigid skull → ↑ ICP → herniation risk. Most dangerous consequence.

Seizures & Coma

Occurs when Na^+ drops rapidly or falls below ~120 mEq/L. Requires airway protection.

Osmotic Demyelination Syndrome (ODS)

Caused by **correcting sodium TOO FAST**. Destroys myelin in the pons. Results in paralysis, dysphagia, "locked-in" syndrome. *Irreversible*.

Falls & Fractures

From lethargy, confusion, orthostatic hypotension — especially in older adults.

Hypernatremia Complications

Intracranial Hemorrhage

Brain shrinks and tears bridging veins → subdural hematoma. High mortality.

Seizures & Coma

From osmotic shifts in the brain. Priority = airway and safety.

Cerebral Edema (From Over-Correction)

If Na^+ is lowered too fast, water rushes into dehydrated brain cells → **rebound swelling & herniation**.

Renal Injury

Severe dehydration reduces renal perfusion → AKI; watch urine output and creatinine.

08 Nutrition & Diet

FOOD IS MEDICINE

Hyponatremia Diet

Goal: Increase sodium intake (*only if not SIADH or fluid-overloaded*) · limit free water.

Foods to Encourage



Canned soups, broths, bouillon



Salted pretzels, crackers



Cheese (cheddar, cottage)



Bacon, ham, deli meats



Pickles, olives, sauerkraut



Tomato juice · V8 juice



Salted nuts, seeds



Soy sauce, table salt (per HCP)

Limit:

Plain water, tea, coffee, hypotonic fluids — especially in SIADH. Avoid beer (beer potomania worsens Na⁺).

Hypernatremia Diet

Goal: Restrict sodium · increase water intake · read every food label.

Foods to Encourage



Plain water (2–3 L/day if allowed)



Fresh fruits (watermelon, berries)



Fresh vegetables



Plain rice, pasta (unsalted)



Fresh (not processed) meats



Low-sodium milk, yogurt



Herbs & spices instead of salt



Lemon juice, vinegar for flavor

Avoid:

Canned soups, processed deli meats, bacon, hot dogs, pickles, olives, soy sauce, frozen dinners, chips, fast food, table salt, pre-packaged mixes.

09 NCLEX Test Traps

WHERE STUDENTS LOSE POINTS

⚠ CORRECTION SPEED

Never correct sodium rapidly

The most tested pitfall. Correct Na^+ by **no more than 8–12 mEq/L in 24 hours** — either direction.

Fast fix



Slow & steady

Rapid $\uparrow \text{Na}^+$ = osmotic demyelination syndrome (permanent).

Rapid $\downarrow \text{Na}^+$ = cerebral edema + herniation.

⚠ 3% SALINE

Hypertonic saline needs a central line

3% NaCl is caustic to peripheral veins. Always on an IV pump. Monitor Na^+ hourly. Watch for fluid overload (crackles, JVD, dyspnea).

Peripheral IV



Central line + pump

⚠ PRIORITY ACTION

Neuro symptoms = priority over labs

A seizing client with Na^+ 118 needs **airway protection first**, not another BMP. Safety (ABCs) > lab result.

Draw labs first



Protect airway first

⚠ FLUID DIRECTION

Reverse fluid = correction

Hyponatremia → isotonic/**hypertonic** fluids (add solute).

Hypernatremia → **hypotonic** fluids (add water).

D5W for hyponatremia



NS or 3% NaCl

⚠ SIADH TRAP

SIADH = restrict water, NOT give salt alone

In SIADH, the body retains water → sodium looks low but total body sodium is normal. Primary intervention = **fluid restriction**.

Give IV D5W



Restrict fluids

⚠ THIRST RELIABILITY

Don't trust thirst in older adults & infants

Thirst mechanism is blunted in the elderly and absent in unconscious or infant clients. Never rely on "patient can ask for water" as a plan.

Wait for thirst



Schedule fluids

⚠ LOOK-ALIKE LABS

Pseudo-hyponatremia is real

⚠ TUBE FEEDING ERROR

Tube feeds without water flushes = hypernatremia

Severe hyperglycemia (DKA) or hyperlipidemia can make sodium falsely appear low. For every 100 mg/dL glucose rise above 100, Na^+ decreases by ~1.6 mEq/L — correct the glucose first.

Concentrated enteral formulas pull water from cells. Flush free water before/after feedings and q4h — a frequent NCLEX scenario.

10 NCJMM • Clinical Judgment Scenario

NEXT GEN NCLEX

Scenario: A 74-year-old client admitted with small cell lung cancer is drowsy and confused. BP 112/68, HR 88, RR 18, SpO_2 95%. The client reports a recent headache and nausea. Labs: Na^+ **118 mEq/L**, K^+ 3.9, serum osmolality 258 mOsm/kg, urine osmolality 520 mOsm/kg. I&O: intake 2,400 mL / output 800 mL over 24 hours. The HCP suspects SIADH.

STEP 1

Recognize Cues

- Na^+ 118 (critical low)
- ↓ serum osm, ↑ urine osm
- Drowsy, confused, H/A, N
- Intake > output (fluid retention)
- Lung cancer (classic SIADH)

STEP 2

Analyze Cues

- Dilutional hyponatremia → SIADH
- Brain cells are swelling
- Risk for seizure / herniation
- Not a sodium shortage — a water excess

STEP 3

Prioritize & Act

- Institute seizure precautions NOW
- Strict fluid restriction ($\leq 1,000$ mL/day)
- Anticipate 3% NaCl via central line
- Q2h neuro & Na^+ checks
- Daily weight · strict I&O

STEP 4

Evaluate Outcomes

- Na^+ rising ≤ 12 mEq/L in 24h
- LOC improving, A&O $\times 3$
- No seizure activity
- Urine output balanced with intake
- No signs of ODS (no new weakness)

11 Patient & Family Education

DISCHARGE TEACHING

Teaching for Hyponatremia

- ✓ Follow prescribed fluid limits — use a marked water bottle to track intake.
- ✓ Weigh yourself daily at the same time, same clothes, same scale — report ≥ 2 lb gain overnight.
- ✓ Recognize early symptoms: headache, nausea, muscle cramps, fatigue → call provider.
- ✓ Add sodium-rich foods ONLY if approved (broth, crackers, cheese, deli meats).
- ✓ Take all medications as prescribed; never stop thiazides or SSRIs without calling HCP.
- ✓ Avoid drinking large amounts of plain water during exercise — choose sports drinks if sweating heavily.
- ✓ Report confusion, worsening weakness, or seizure activity → 911.

Teaching for Hypernatremia

- ✓ Drink water consistently throughout the day — don't wait until thirsty (especially older adults).
- ✓ Read food labels: look for sodium < 140 mg per serving; aim for $< 2,000$ mg/day total.
- ✓ Use herbs, garlic, lemon, and salt-free seasoning blends instead of table salt.
- ✓ Avoid canned, smoked, cured, pickled, or processed foods.
- ✓ For tube feeds: always give prescribed free water flushes on schedule.
- ✓ Recognize warning signs: intense thirst, dark urine, dry mouth, confusion, restlessness.
- ✓ During fever, heat, or illness → increase fluids and call HCP if unable to drink.
- ✓ Diabetes insipidus? Take DDAVP exactly as ordered; keep fluid-intake log.

12 Memory Boosters & Mnemonics

MAKE IT STICK

SALT LOSS

Remember: Hyponatremia = Sodium Lost

- S** Stupor / coma

- A** Anorexia, nausea, vomiting

- L** Lethargy & fatigue

- T** Tendon reflexes diminished (hypo DTRs)

- L** Loss of urine & appetite

- O** Orthostatic hypotension

- S** Seizures, headache, spasms

- S** Stomach cramps, muscle cramps

FRIED SALT

Remember: Hypernatremia = "Fried & Salty"

- F** Fever (low-grade), flushed skin

- R** Restlessness, irritability

- I** Increased fluid retention / ↑ BP

- E** Edema (peripheral)

- D** Decreased urine output (dark)

- S** Skin dry & flushed

- A** Agitation → seizures

- L** Low-grade fever

- T** Thirst (intense), swollen tongue

Pattern Recognition — Quick Associations

Water follows salt

Wherever sodium moves, water moves with it.
This single rule explains every shift.

Hypo = SWELL

Both start with "S" — low sodium, cells swell,
brain swells → seizures.

Hyper = SHRINK

High sodium, cells shrink, brain shrinks → bleed
risk, intense thirst.

8–12 Rule

Correct sodium $\leq 8\text{--}12$ mEq/L per 24 hours —
either direction. Always.

"SIADH holds on"

SIADH = *Soaked* Inside, Antidiuretic Hormone =
body holds water → dilutional hypoNa.

"DI dumps it"

DI = Dry Inside, body *dumps* water →
concentrated blood → hyperNa.

NGN NCLEX 2026 Study Series

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