ICR-HYNA-037

Critical care · electrolytes

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CRITICAL CARE ORDER SET

Hyponatremia

Diagnosis and management of hyponatremia in the ICU. Two questions drive everything: how sick is the brain right now, and how fast is the sodium allowed to rise. Treat severe symptoms immediately with hypertonic saline, classify by the four-question workup, then correct slowly — guarding against osmotic demyelination at every step. Adapt thresholds to your protocol.

Severe symptoms? → hypertonic saline now

Seizures, coma, respiratory arrest, or signs of cerebral herniation — give 3% NaCl immediately (Section 04); don't wait for the full workup.

01 Initial diagnostics

BASELINE LABS — STAT

- [ ] Serum — Na, K, Cl, HCO_3, BUN, creatinine, glucose, Ca, Mg, phosphate
- [ ] **Urine** — Na, K, osmolality, creatinine
- [ ] Ethanol, triglycerides, total protein if pseudohyponatremia suspected
- [ ] Pregnancy test (childbearing potential)
- [ ] **Serum osmolality**
- [ ] a.m. cortisol & TSH (free T4 if TSH abnormal) if not recently checked
- [ ] VBG/ABG as indicated; BNP, troponin, LFTs as clinically indicated

CORRECT FOR GLUCOSE

With hyperglycemia, interpret Na using the corrected-sodium formula — **add ~2.4 mEq/L to measured Na for every 100 mg/dL of glucose above 100**.

02 Diagnostic algorithm — four critical questions

Q1 Is it real hyponatremia? — check serum osmolality

Low < 280	Normal / high	Pseudo
True (hypotonic) hyponatremia → Q2	**Hypertonic / isotonic** — hyperglycemia, mannitol, IVIG, irrigation (sorbitol/glycine)	**Pseudohyponatremia** — hyperlipidemia, hyperproteinemia. Misleading: uremia, ETOH

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Q2 Is water excretion appropriate? — check urine osmolality

Low < 100 mOsm/kg	High > 100 mOsm/kg
Appropriate ADH suppression — **water intoxication** (psychogenic polydipsia, ecstasy, marathon) or **low-solute diet** (beer potomania, tea & toast)	ADH active → assess volume status (Q3)

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Q3 Is ADH secretion appropriate? — check volume status

Hypovolemia	Euvolemia	Hypervolemia
Appropriate ADH — ↓↓Na, ↓H_2O	Inappropriate ADH — ↔Na, ↑↑H_2O	Maladaptive ADH — ↑Na, ↑↑H_2O (HF, cirrhosis, nephrotic, renal failure)

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Q4 What is the urine sodium?

U_{Na} > 40 mEq/L	U_{Na} < 25 mEq/L
Renal losses — diuretics, primary adrenal insufficiency, bicarbonaturia, osmotic diuresis, cerebral salt wasting. (Euvolemic: SIADH, reset osmostat, glucocorticoid deficiency, severe hypothyroidism)	**Extrarenal losses** — GI losses, third-spacing (hypovolemic); or HF / cirrhosis / nephrotic (hypervolemic)

INDETERMINATE **U_{Na} 25–40 mEq/L** — infuse 1 L isotonic saline and re-measure urine sodium & osmolality serially to separate hypovolemia from SIADH.

03 Classification & monitoring

DOCUMENT — ONSET, SEVERITY, SYMPTOMS, VOLUME STATUS

ONSET

Acute < 48 h · **Chronic** ≥ 48 h or unknown

SEVERITY (NA MEQ/L)

Mild 130–134 · **Moderate** 125–129 · **Severe** < 125

SYMPTOMS

Severe: seizures, coma, resp arrest, herniation · **Moderate:** vomiting, somnolence, confusion, headache · **Mild:** nausea, mild gait change

VOLUME STATUS

Hypovolemic / euvolemic / hypervolemic (exam + labs)

MONITORING ORDERS

- [ ] **Neuro checks** — severe symptoms / on hypertonic saline: **q1h × 6h** then q2–4h; mild–moderate: **q4h**
- [ ] **Serum Na** — during 3% saline / active correction: **q2–4h**; stable / conservative: **q6–8h**
- [ ] Vital signs **q1h** if symptomatic / on hypertonic, else q4h; strict I/O & daily weights
- [ ] Continuous cardiac monitoring if on 3% saline, significant electrolyte derangement, or severe symptoms

04 Correction targets & safety

USUAL TARGET NA RISE

≤ 8 mEq/L / first 24 h

HIGH ODS RISK

≤ 6 mEq/L / first 24 h

Na ≤ 105, alcoholism, malnutrition, advanced liver disease, hypokalemia

HARD STOP **≤ 10–12 mEq/L in any 24 h** and **≤ 18 mEq/L in any 48 h** — to prevent osmotic demyelination syndrome.

IF NA RISES TOO QUICKLY

- [ ] Hold hypertonic saline; consider **desmopressin 2–4 µg IV/SC × 1–2** and/or D5W to slow / re-lower Na (Section 08)

05 Severe symptomatic hyponatremia

INDICATION Na usually **< 120 mEq/L and** severe neuro symptoms (seizures, coma, impending herniation).

3% hypertonic saline — bolus

- [ ] **3% NaCl 100 mL IV over 10 min**, may repeat up to 2 more times (total up to 300 mL) if severe symptoms persist — Na check after each or every 2nd bolus
- [ ] **Target** — initial Na increase **4–6 mEq/L** or clear clinical improvement, whichever first
- [ ] Weight-based alt (access / body-size extremes) — **2 mL/kg IV over 10–20 min** (max 150 mL/bolus), repeat as above
- [ ] Monitor — serum Na & K **q2h** until stable; continuous cardiac & neuro monitoring

THEN After stabilization, switch to a volume- and cause-based strategy (Sections 06–07).

06 Volume-based treatment strategy

A · Hypovolemic — GI losses, diuretics, adrenal insufficiency, third-spacing

- [ ] **0.9% NaCl IV** at **75–150 mL/h** (titrate to hemodynamics & target); for shock **500–1000 mL** bolus then reassess. Hold offending diuretics
- [ ] Adrenal insufficiency suspected — **hydrocortisone 50–100 mg IV q6–8h** while awaiting cortisol (Section 07)
- [ ] Serum Na q4h initially — if rapid aquaresis (Na rising > 8 mEq/L/24h), see Section 08

B · Euvolemic (SIADH) — CNS / pulmonary disease, drugs, pain, nausea, post-op

- [ ] **Fluid restriction ≤ 800–1000 mL/day** (all routes; 800 mL if Na very low); stop / substitute offending agents (SSRIs, carbamazepine, thiazides) if feasible
- [ ] **3% NaCl infusion** (moderate symptoms or Na < 120) — start **0.5–1 mL/kg/h**, Na q2–4h, target ≤ 8 mEq/L/day
- [ ] **Furosemide 20–40 mg IV q6–12h PRN** to enhance free-water clearance (if not hypovolemic); replace K (Section 06D)
- [ ] **Urea** 15–30 g PO once–twice daily (if available), titrate to Na & tolerance

- [ ] **Vaptans** — not first-line in ICU; chronic / resistant SIADH only, with very close Na monitoring (q4–6h). Tolvaptan 15 mg PO daily, titrate 30–60 mg. **Avoid in liver failure / acute symptomatic.**

C · Hypervolemic — heart failure, cirrhosis, advanced CKD

- [ ] **Fluid restriction ≤ 800–1000 mL/day** + dietary **Na < 2 g/day**
- [ ] **Furosemide 20–80 mg IV** (or equivalent), titrate to UOP & renal function; continue guideline-directed HF / cirrhosis therapy
- [ ] Vaptan (specialist input) in resistant severe cases — tolvaptan 15 mg PO daily; avoid aggressive diuresis, watch creatinine / electrolytes

D · Potassium repletion — all phenotypes

> **NOTE** Correcting hypokalemia **raises plasma Na** — count it toward the daily correction limit.

- [ ] Target **K ≥ 4.0 mEq/L**. KCl `10 mEq IV in 100 mL NS over 1h × up to 4` (central + monitoring: up to 20 mEq/h). Check K & Mg q4–6h while repleting

07 Special etiologies

Adrenal insufficiency

- [ ] Acute — **hydrocortisone 100 mg IV bolus**, then 50 mg IV q6h or 200 mg/24h infusion; taper per endocrine
- [ ] Chronic primary AI — consider fludrocortisone 0.1 mg PO daily once stable

Hypothyroidism

- [ ] **Levothyroxine 25–50 µg IV/PO daily**, adjust per TSH / free T4 & cardiac status
- [ ] Myxedema coma → more aggressive regimen (see dedicated protocol)

08 Prevention & management of overcorrection

Prevent rapid overcorrection — proactive “DDAVP clamp”

- [ ] Very high ODS risk (Na ≤ 105, alcoholism, malnutrition, advanced liver disease, hypokalemia) or anticipated large aquaresis — **desmopressin 1–2 µg IV/SC q6–8h** + carefully titrated 3% saline; serum Na q2–4h

If overcorrection occurs — rise > 8 mEq/L in 24h, or exceeds target in high-risk patient

- [ ] **Stop** all hypertonic / NS infusions (unless needed for shock)
- [ ] **Desmopressin 2–4 µg IV/SC once**, may repeat q6–8h × 1–2 to halt water diuresis
- [ ] **Re-lower with D5W 3–6 mL/kg/h** until Na approaches goal, then slow / stop; check Na q2h during active re-lowering

09 Medication safety & supportive care

MEDICATION SAFETY

- [ ] Renal / hepatic dose adjustment on all agents
- [ ] Minimize hyponatremia-worsening drugs — **thiazides, SSRIs, carbamazepine / oxcarbazepine, some antipsychotics**, MDMA, vincristine, cyclophosphamide
- [ ] Don't correct hyperglycemia too rapidly in hyperosmolar states; use corrected-Na formula

NURSING & SUPPORTIVE CARE

- [ ] **Seizure precautions** for Na < 120 or neuro symptoms
- [ ] **Fall precautions** for confused / gait-unstable patients
- [ ] NPO or thickened liquids if aspiration risk from encephalopathy
- [ ] Dietitian consult — malnutrition, chronic alcohol use, severe hyponatremia