

Hyponatremia – An Algorithmic Approach

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Case - 3

- 7-year-old boy with facial & leg swelling
- Reduced urine output, past similar episodes

On examination:

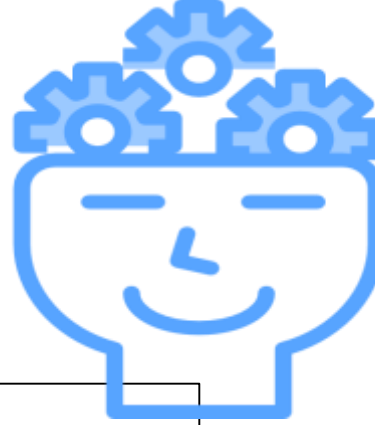
- Puffy face, periorbital edema, pedal edema (weight gain +2.5 kg)
- Mild subcostal retractions, ↓ air entry bilaterally
- HR 110/min, RR 28/min, BP 100/64 mmHg, SpO₂ 94%,

Initial Labs

- Na⁺ **122 mEq/L**, K⁺ 4 mEq/L
- Albumin **2 g/dL**
- Urea 39 mg/dL, Creatinine 0.48 mg/dL
- ABG: pH 7.36, pO₂ 46, CBG: 97 mg/dL
- What is the likely diagnosis?

Likely Diagnosis

- Nephrotic Syndrome (relapse)
- Hypervolemic Hyponatremia
- Respiratory distress from fluid overload



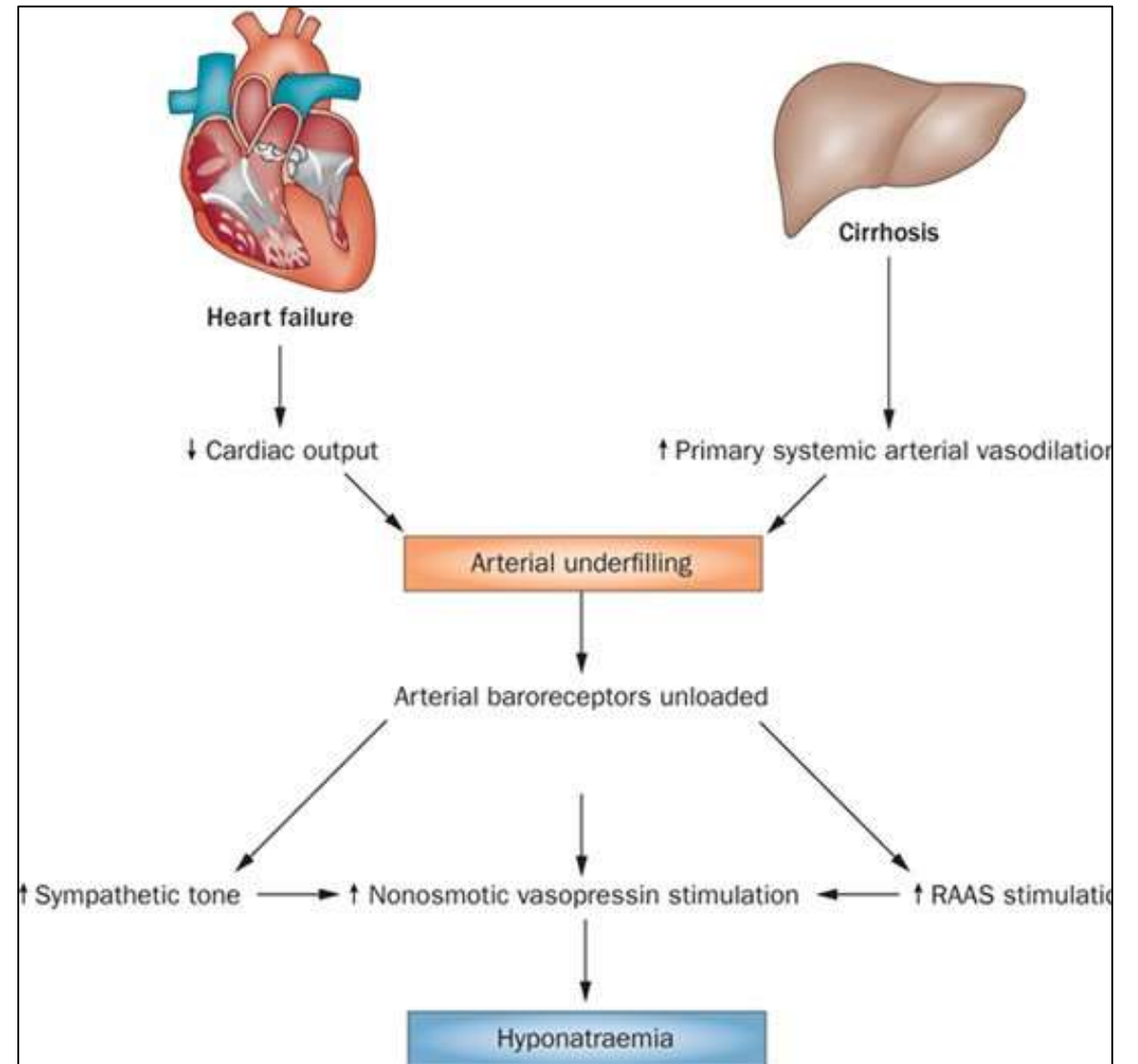
- Can you enumerate some other conditions where you could encounter hypervolemic hyponatremia?

Hyponatremia in Hypervolemia – Causes

- Nephrotic syndrome
- Congestive heart failure
- Chronic liver disease
- Renal failure

Pathophysiology

- $\downarrow$ Oncotic pressure $\rightarrow$ Edema
- Effective arterial hypovolemia $\rightarrow$ RAAS + ADH
- $\uparrow$ Water retention $>$ Na^+ retention
- Dilutional hyponatremia

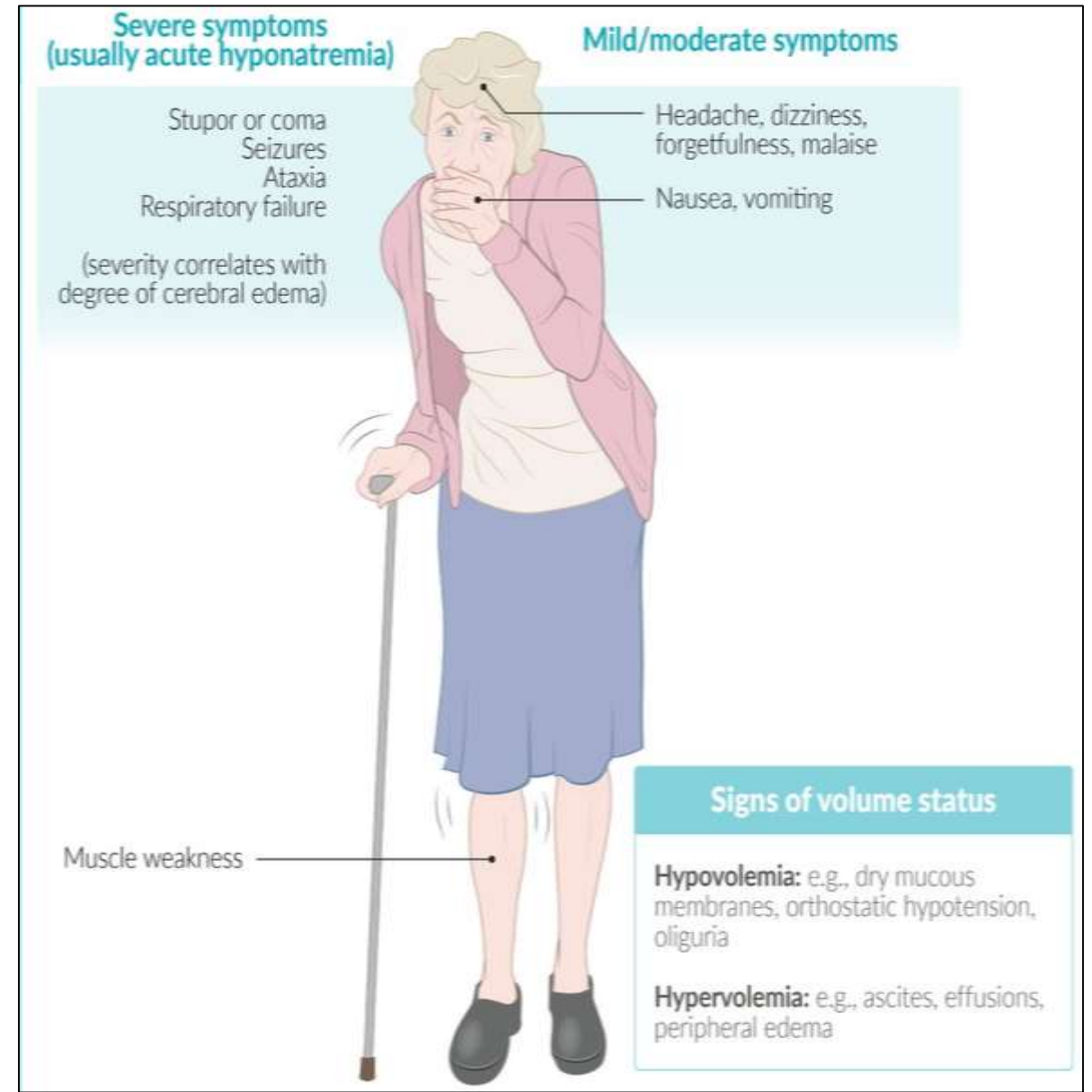


Key Concept

- Hypervolemic but Hypo-effective Circulation
- Expanded extracellular fluid
- Kidneys conserve water/salt
- ADH → Na⁺ dilution

Clinical Features

- Edema, ascites, effusion
- Dyspnea, orthopnea
- Weight gain
- Hyponatremic symptoms: headache, seizures



Severity Assessment

- Mild: Na^+ 125–134 (asymptomatic)
- Moderate: Na^+ 120–125 (GI, headache, lethargy)
- Severe: <120 (seizures, coma, cerebral edema)

Stepwise Evaluation

- History & clinical exam
- Serum electrolytes, albumin, renal function
- Urine sodium/osmolality
- CXR (effusion, edema), USG abdomen (ascites)

Principles of Management

- Treat underlying cause
- Restrict free water intake
- Control edema/effusions
- Correct Na^+ safely ($\leq 8\text{--}10$ mEq/L per 24 hrs)

Fluid & Sodium Restriction

Fluid: 2/3
maintenance

Sodium
restriction in
nephrotic/cardia
c/liver causes

Avoid hypotonic
fluids

Diuretics- role in hypervolemic hyponatremia

- Loop diuretics (Furosemide) for fluid overload
- Monitor: K^+ , renal function
- Combine with albumin infusion in nephrotic relapse

Role of Albumin Infusion

- Indicated with hypoalbuminemia + edema
- 20% Albumin + Furosemide
- Improves intravascular volume
- Mobilizes fluid

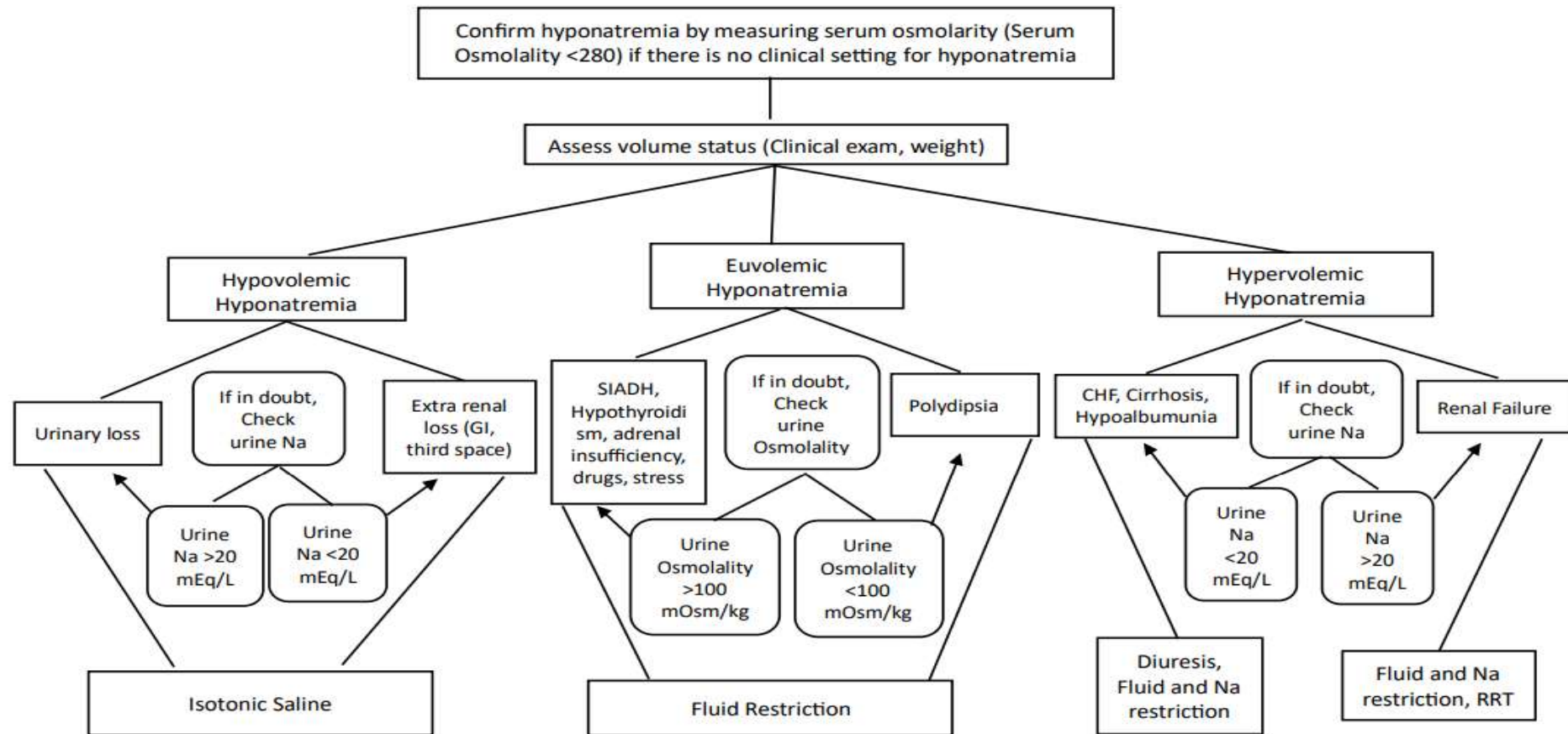
Hypertonic Saline – When and how?

- For symptomatic severe hyponatremia ($\text{Na}^+ < 120$ with seizures)
- 3% NaCl: 2–3 mL/kg over 30 min
- Target: raise Na^+ by 4–6 mEq in 6 hrs

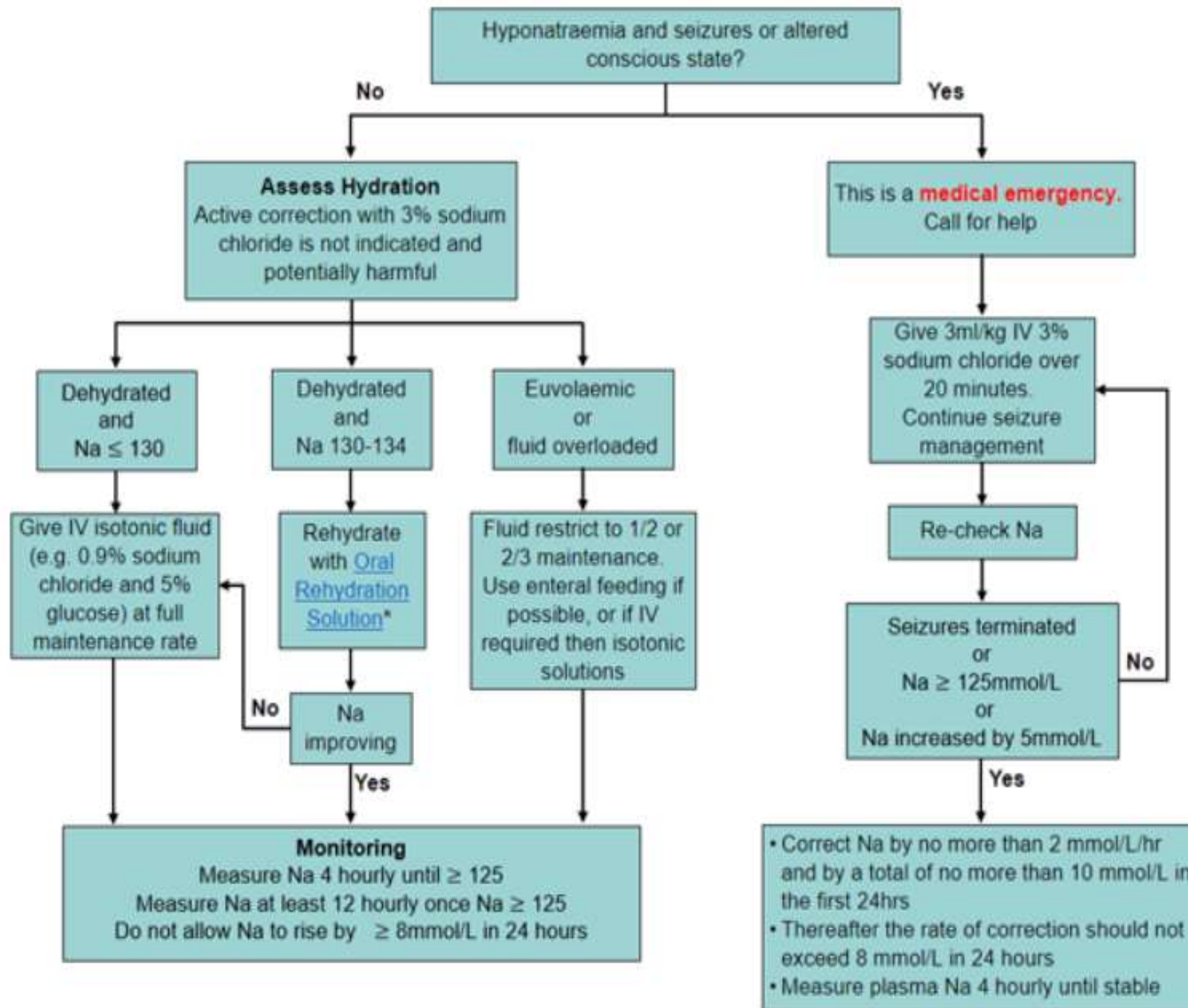
Other Supportive Measures

- Oxygen for hypoxemia
- Monitor input–output, daily weight
- Dialysis- ESKD
- Nutrition optimization
- Steroids in nephrotic relapse

Algorithm



Approach-Continued



Pitfalls to Avoid

- Rapid correction → osmotic demyelination
- Excessive fluid boluses
- Ignoring underlying cause (relapse, CHF)

Take-Home Messages

- Hyponatremia in hypervolemia = dilutional
- Correction must be cautious
- Always address underlying pathology
- Close monitoring is vital

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