Hyponatremia Algorithm

Measured Serum Osmolality

Normal (~ 280 mOsm) Isotonic

Pseudohyponatremia
Hypertriglyceridemia, hyperglobulinemia
Ion-specific electrodes has alleviated this lab error

Hypovolemic Hypotonic Hyponatremia
Total body water ↓
Total body sodium ↓↓
Effective arterial blood volume low

Uosm > 450 mOsm/kg

Una < 20 meq/l
Causes:
Extrarenal Losses
Vomiting, Diarrhea
Third Spacing (burns, pancreatitis), Bowel obstruction, Trauma, Sweating,

Treatment:
Onset Slow (>48 hours): 0.9% NaCl
Onset Rapid (<48 hours): 3% NaCl and loop diuretic
Stop offending medications; restore intravascular volume with 0.9% NaCl

Una > 20 meq/l
Causes:
Renal Losses
Diuretics,
Mineralocorticoid deficiency (aldosterone),
Salt losing Nephritis,
Bicarbonaturia (renal tubular acidosis, metabolic alkalosis),
Cerebral Salt Wasting Syndrome,
Ketonuria, Osmotic diuresis

Treatment:
Onset Slow (>48 hours): Fluid restriction
Onset Rapid (<48 hours): 3%
NaCl and loop diuretic
Optimize treatment of underlying disease; restrict salt and water intake; give loop diuretics

Elevated (> 280 mOsm) Hypertonic

Hyperglycemia
Unmeasured effective osmoles (glycine, mannitol, sorbitol, maltose, radiocontrast dyes)

Hyperosmolal Hyponatremia

Low (<280 mOsm) Hypotonic Hyponatremia

Hypervolemic Hypotonic Hyponatremia
Total body water ↑↑
Total body sodium ↑

Uosm > 100 mOsm/kg

Una < 20 meq/l

Untreated appropriate low

Causes:
Primary polydipsia (psychogenic polydipsia),
Low solute intake (beer potomania syndrome)

Treatment:
Dialysis

Uosm < 100 mOsm/kg

Inappropriately High

Causes:
Hypothyroidism (TSH level), Glucocorticoid deficiency (adrenocorticotrophic stimulation test);
SIADH, Stress, Drugs,

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Euvolemic Hypotonic Hyponatremia (no edema)

Total Body Water ↑
Total Body Sodium ↔

Uosm > 100 mOsm/kg

Una > 20 meq/l

Treatment:
Dialysis

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Uosm < 100 mOsm/kg

Una < 20 meq/l

Causes:
Primary polydipsia (psychogenic polydipsia),
Low solute intake (beer potomania syndrome)

Treatment:
Fluid restrict

Fluid restrict
Severe Euvolemic Hyptonic Hyponatremia (Serum Sodium < 125 meq/l)

Symptomatic
Confusion, ataxia, seizures, obtundation, coma, respiratory depression

Acute < 48 hours

Chronic > 48 hours or Unknown Duration

Treatment:
3% Sodium Chloride 1-2 ml/kg/hour until symptoms resolve, then 0.5 ml/kg/hour
Sodium should not increase any faster than 12 meq/L in first 24 hours, or 20 meq/L in the first 48 hours. Stop 3% Sodium Chloride as soon as medical possible.

Water restriction, 3% NaCl plus loop diuretic, stop offending medications; hormone replacement

If urine mOsm > 300 a loop diuretic may be needed to enhance water excretion

The sum of urinary cations (Una + Uk) should be less than the concentration of the infused sodium to ensure excretion of electrolyte-free water.

Asymptomatic or mild symptoms (headache, lethargy, dizziness)

Chronic
Rarely < 48 hours

No immediate correction needed

Long Term Management
Identify and treat reversible causes
Water restriction
Furosemide with 2-3 g of sodium chloride per day
Demeclocycline, 1200 mg on day one then 300-600 mg bid (avoid if renal or hepatic insufficiency)
Urea 15-60 g/day

There is no consensus about the optimal treatment of symptomatic hyponatremia. Correction should be of a sufficient pace and magnitude to reverse the manifestations of hypotonicity, but not so rapid and large as to pose a risk for developing osmotic demyelination.

For mild symptoms of hyponatremia, or asymptomatic patients with serum sodium above 125 meq/l, use a conservative approach. (Water restriction less than 1-1.25 l/day) If serum sodium continues to decline 0.9% NaCl may be given to clarify diagnosis. If the patient has SIADH, hyponatremia will worsen and if they are ECF volume contracted serum sodium will improve.