Hyponatremia

Serum Sodium <135 mEq per L

Symptomatic

Severe hyponatremia

Serum Sodium < 125 mEq per L

Euovolemic

Hypovolemic

Infuse 3% saline (1 to 2ml/kg/hr) with goal of increasing serum sodium level by 6 to 8 mEq/L (not to exceed 10 to 12 mEq/L in the first 24 hrs or 18 mEq/L in 48 hrs) consider desmopressin , 1 to 2 mcg every 4 to 6 hrs. (1)

Give single IV bolus of 100 to 150 ml 3% saline with goal of increasing serum sodium level by 2 to 3 mEq/L; check sodium level every 20 minutes until symptoms resolve , may repeat bolus twice if symptoms don't resolve (1)

Symptoms resolve

Check serum sodium level every two hours: adjust infusion rate and switch to isotonic saline

Asymptomatic

Or mild symptoms

Monitor serum sodium daily

Calculate Serum Osmolality

$$(2 * (Na + K)) + \frac{glucose}{18} + \frac{BUN}{2.8}$$ (5)(6)

Hypotonic Hyponatremia

< 280 mEq per L

Isotonic Hyponatremia

(Pseudohyponatremia)

280-285 mEq per L

Hypertonic Hyponatremia

> 285 mEq per L

(with normal total body sodium)

Assess for hyperglycemia, check for mannitol or sorbitol use or recent administration of radiocontrast media

Then follow up

Condition	Treatment
Hyperglyemia	Insulin, IV fluid isotonic saline
Hyperlipidemia	Statin therapy
Hyperproteinemia	Chemotherapy
Laboratory errors	-

(1)

In case of hyperglycaemia calculate corrected sodium

$$Measured\ sodium + 0.016 * (serum\ gluose - 100)$$ (5)(6)

Assess volume status

Hypovolemic Hypotonic Hyponatremia

Condition		Treatment
Cerebral salt wasting	Urinary sodium >20 mEq per L	Isotonic or hypertonic saline
Diuretic use	Urinary sodium >20 mEq per L	Stop diuretic therapy
Gastrointestinal loss (e.g., diarrhea, vomiting)	Urinary sodium <20 mEq per L	Intravenous fluids
Mineralocorticoid deficiency (e.g., Addison disease [primary], pituitary failure [secondary], hypothalamic failure [tertiary])	Urinary sodium >20 mEq per L	Steroid replacement therapy
Osmotic diuresis		Correct glucose level, stop mannitol use
Renal tubular acidosis	Urinary sodium >25 mEq per L	Correct acidosis, sodium bicarbonate
Salt-wasting nephropathies	Urinary sodium >20 mEq per L	Correct underlying cause
Third spacing (e.g., bowel obstruction, burns)		Intravenous fluids, relieve obstruction

(1)

Euvolemic Hypotonic Hyponatremia

Urinary sodium >20 mEq per L

Hypervolemic Hypotonic Hyponatremia

Urinary sodium <20 mEq per L

Condition	Treatment
Heart faliure	Duiretics, ACE inhibitors, Beta Blokers
Hepatic failure /Cirrhosis	Furesamide(Lasix), Spironolactone(Aldactone), Transpant
Nephrotic	Treat underlying cause

(1)

Urinary sodium >20 mEq per L

Condition	Treatment
Renal Failure	Correct underlying Disease with ACE inhibtors or ARBs

(1)

Condition	Treatment
Exercise-associated hyponatremia	Isotonic or hypertonic saline, depending on symptoms
Glucocorticoid deficiency	Steroid replacement therapy
Hypothyroidism	Thyroid replacement therapy
Low solute intake	Increase sodium intake
SIADH	Fluid restriction, consider vaptans
Nephrogenic SIADH	Fluid restriction, loop diuretics
SIADH secondary to medication use (e.g., barbiturates, carbamazepine [Tegretol], chlorpropamide, diuretics, opioids, selective serotonin reuptake inhibitors, tolbutamide, vincristine)	Stop causative medication
Water intoxication	Diuresis

(1)

❖ After Correction of all underlying causes

Hyponatremia Deficit Calculation:

1. Sodium deficit = Total body water % × weight in kg × (desired sodium − actual sodium)
   For total body water %, use 0.6 for men and 0.5 for women
   Desired sodium=120 mEq/L

2. Amount needed to increase serum sodium level by 0.5mEq/L/hr
   Total body water % × weight in kg × 0.5mEq/L/hr

3. Infusion Rate of hypertonic(3%) saline solution (513mEq/L of Na)

$$\frac{(\text{Total body water \%} \times \text{weight in kg} \times 0.5\text{mEq/L/hr}) \times 1000}{513}$$

4. Total infusion Time (hrs) = $\frac{(Equation\ 1)}{(Equation\ 2)}$

(5)(6)

Vaptans indication

Short term use for hospitalized patient with hypervolemic or euovolemic hyponatremia associated with heart failure or syndrome of inappropriate ADH secretion with sodium

<125mEq/L

(1)