Guidelines

For The Management Of

Hyponatraemia

By

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Setting Clinical and Professional Excellence

Hyponatraemia

Serum sodium less than135 mmol/l. A level less than120 mmol/l is considered sever

Presentation
Depends on the cause, severity, chronicity (more than 48 hrs) and rate of fall of serum sodium
Headache, nausea and vomiting, weakness muscle cramps, convulsions, apathy, confusion
In patients with hyponatremia due to ***decreased extracellular volume ECF :***
postural hypotension, dry mucus membranes, cold and clammy skin
In patients with hyponatremia due to ***normal or increased extracellular volume ECF :***
edema, weight gain, elevated blood pressure

Signs
>Level of alertness ranging from alert to comatose
>Focal or generalized seizure activity
>Patients with acute severe hyponatremia, signs of cerebral oedema &brainstem herniation, including coma; fixed, unilateral, dilated pupil; decorticate or decerebrate posturing; sudden severe hypertension and respiratory arrest
>Dry mucous membranes, tachycardia, diminished skin turgor, and orthostasis suggest hypovolemic hyponatremia.
>Pulmonary crepitations, S_3 gallop, jugular venous distention, peripheral edema, or ascites suggest hypervolemic hyponatremia due to salt & water retention (i.e., liver cirrhosis, nephrotic syndrome, and congestive heart failure).
>Patients who lack findings of hypovolemia or hypervolemia are considered to have euvolemic hyponatremia, which is consistent with such etiologies as exogenous free water load, hypothyroidism, cortisol deficiency, or SIADH.

Differential Diagnoses
Congestive heart failure and pulmonary edema,
Liver cirrhosis
Acute renal failure
Chronic renal failure and dialysis complications
Nephrotic Syndrome
Gastroenteritis with loss of fluid & electrolytes
Hypothyroidism
Adrenal insufficiency and adrenal crisis
Syndrome of inappropriate aintidiuretic hormone secretion

Investigation
Serum and urine osmolality,
urine sodium concentration
Renal and liver function tests
Glucose& lipid profile
Thyroid and adrenal function tests

Imaging Studies

Imaging studies may be indicated depending on the underlying etiology of the hyponatremia (e.g., chest radiograph in a patient with congestive heart failure).
Brain CT scan is indicated in the patient with altered mental status to ensure that no other underlying cause for the mental status is present

Hypovolemic hyponatremia due to
A. nonrenal causes (e.g., vomiting, diarrhea, fistulas, GI drainage, third spacing of fluids-peritonitis, burn & marathon runners) have increased renal absorption of tubular sodium and urine sodium levels of ***less*** than 20mEq/L
B. **renal causes** (e.g., diuretics, salt losing nephropathy, and aldosterone deficiency) have inappropriately elevated urine sodium levels in ***excess*** of 20mEq/L.

Hypervolemic hyponatremia due to decreases in effective circulating volume
(liver cirrhosis, nephrotic syndrome, congestive heart failure) have urine sodium levels of ***less*** than 20 mEq/L

Euvolemic hyponatremia of renal causes or SIADH
has urine sodium levels in ***excess*** of 20mEq/L.

Urine osmolarity may be helpful in establishing the diagnosis of SIADH. Typically, patients with SIADH have inappropriately concentrated urine, with urine osmolarities in excess of 100mOsm/L & the diagnosis is made only after exclusion renal, thyroid, adrenal, pituitary disease or diuretic use.

Treatment:
Depends on: Presence of symptoms
Cause of hyponatremia
Presence of a normal decreased or increased ECF volume.

Admit patients with **severely symptomatic hyponatremia** manifested by coma, recurrent seizures, or evidence of brainstem dysfunction to an ICU to ensure adequate ventilation and monitor serum sodium levels closely
= Severe hyponatremia <110 or symptomatic <120 requires treatment with hypertonic saline 3%
= In general, 20 mg furosemide I.V with 200-400 mL of 3% NaCl /day at maximum rate of 100cc/hr (1cc/kg/hr) for 2 hours is reasonable dose in most ***adult patients*** with severe symptomatic hyponatremia, keeping in mind to measure serum sodium every 2 – 4 hrs
= To avoid osmotic demyelination of pontine and extrapontine neurons correction should proceed at an overall rate that is no greater than 10-12 mEq/L in the first 24 hours and no greater than 18 mEq/L in the first 48 hours at a rate of correction of 1 to 2 mmol /liter / hour for several hours

Pediatric
Administer as in adults

During treatment monitor:
Clinical state, pulse, blood pressure, anorexia, nausea, lethargy, apathy
Central nervous system observations
Fluid balance
Serum sodium every 2 – 4 hrs

Hypovolemic hyponatremia If symptoms are mild to moderately severe, treat with isotonic saline; monitor serum sodium levels frequently to ensure that the serum sodium level increases slowly
give 500 to 3000 ml of normal saline until no longer orthostatic, then give
normal saline (+ 20-40 mEq KCL/ liter) at 65 to 150 ml/hr until desired level is reached
(note: in mild cases, target level of serum sodium of 130 mEq/ Liter).
If severe hyponatremia is present (<115 mEq/L) start hypertonic saline using the dosing guidelines

Hypervolemic hyponatremia sodium and water restriction, diuretics and treat the underlying cause

Euvolemic hyponatremia
Mild cases: free water restriction (less than 800-1000 ml /day), corrects the underlying condition.
Sever cases: 3% hypertonic saline with 20 mg furosemide I.V using the dosing guidelines

SIADH
Furosemide
combined with plentiful sodium intake (in the form of dietary sodium or salt tablets), i.e.
1 tablespoon (containing 15 gm NaCl) keeping in mind that normal requirement of NaCl is 1.5-3.3 g/day
Demeclocycline (Declomycin)
600 to 1200 mg /day can help by inducing nephrogenic diabetes insipidus, With monitoring of renal function
Arginine Vasopressin Antagonists
=antagonism of AVP in the renal collecting ducts results in aquaresis (excretion of free water).
=The vasopressin receptor antagonists conivaptan (Vaprisol) and tolvaptan (Samsca) are now approved for use in hospitalized patients with euvolemic and hypervolemic hyponatremia.

Conivaptan (Vaprisol)
20 mg IV loading dose (infuse over 30 min), followed by 20 mg via continuous IV infusion over 24 h; continue treatment for additional 1-3 d as a 20-mg/d continuous IV infusion; may titrate up to 40 mg/d if necessary

Tolvaptan (Samsca)
15 mg PO qd initially; may increase at 24-h intervals to 30 mg/d; not to exceed 60 mg/day

Indications for stopping the rapid correction of symptomatic hyponatremia (regardless of the method used)
The cessation of life-threatening manifestations,
Moderation of other symptoms,
Achievement of a serum sodium concentration of 125 to 130 mmol per liter (or even lower if the base-line serum sodium concentration is below 100 mmol per liter)

Complications

Complications related to hyponatremia include rhabdomyolysis, seizures, permanent neurologic sequelae related to ongoing seizures or cerebral edema, respiratory arrest, and death.
Complications related to therapy of hyponatremia include fluid overload and the osmotic demyelination syndrome

Further information

A.For calculation of

Serum Osmolality: mOsm/L normal 285 - 295 mOsm/ L
2([Na + K]) + [Glucose] mg/dL /18 + [BUN] mg/dL /2.8
If BUN not available, use B.Urea mg/dl / 6 to convert to mmol/L
urine osmolality: 2 x ([Na + K]) + [glucose] /18 + [urea nitrogen] /2.8

B. For precise estimation for the amount & rate of correction of hyponatremia :
Calculate sodium deficit: 0.6 x (weight in kg) x (desired sodium - Actual sodium)
(Use 0.5 for females)
80kg patient; serum sodium=110 mEq\L ; male; desired target= 120 mEq/L.

1) 0.6 x 80kg x (120-110)= 480 mEq (total needed)
2) Amount needed to increase serum level by 1 mEq/L/hr =
0.6 x 80 x 1= 48 mEq. (Rate should be 48 mEq/hr)
3) 3% hypertonic saline contains 513 mEq/Liter
[desired rate/hr] / 513 x 1000= # ml/hr Total mEq/rate/hr =infusion time.

Therefore: $\frac{48\ mEq/hr}{513} \times 1000 = 93\ ml/hr$

Length of infusion= 480 mEq/ 48mEq= 10 hours
Final order: infuse 3% hypertonic saline at 93 ml/hr for 10 hours
when infusion is complete, discontinue. Continue with fluid restriction, keeping in mind to check serum sodium every 2 - 4 hrs.

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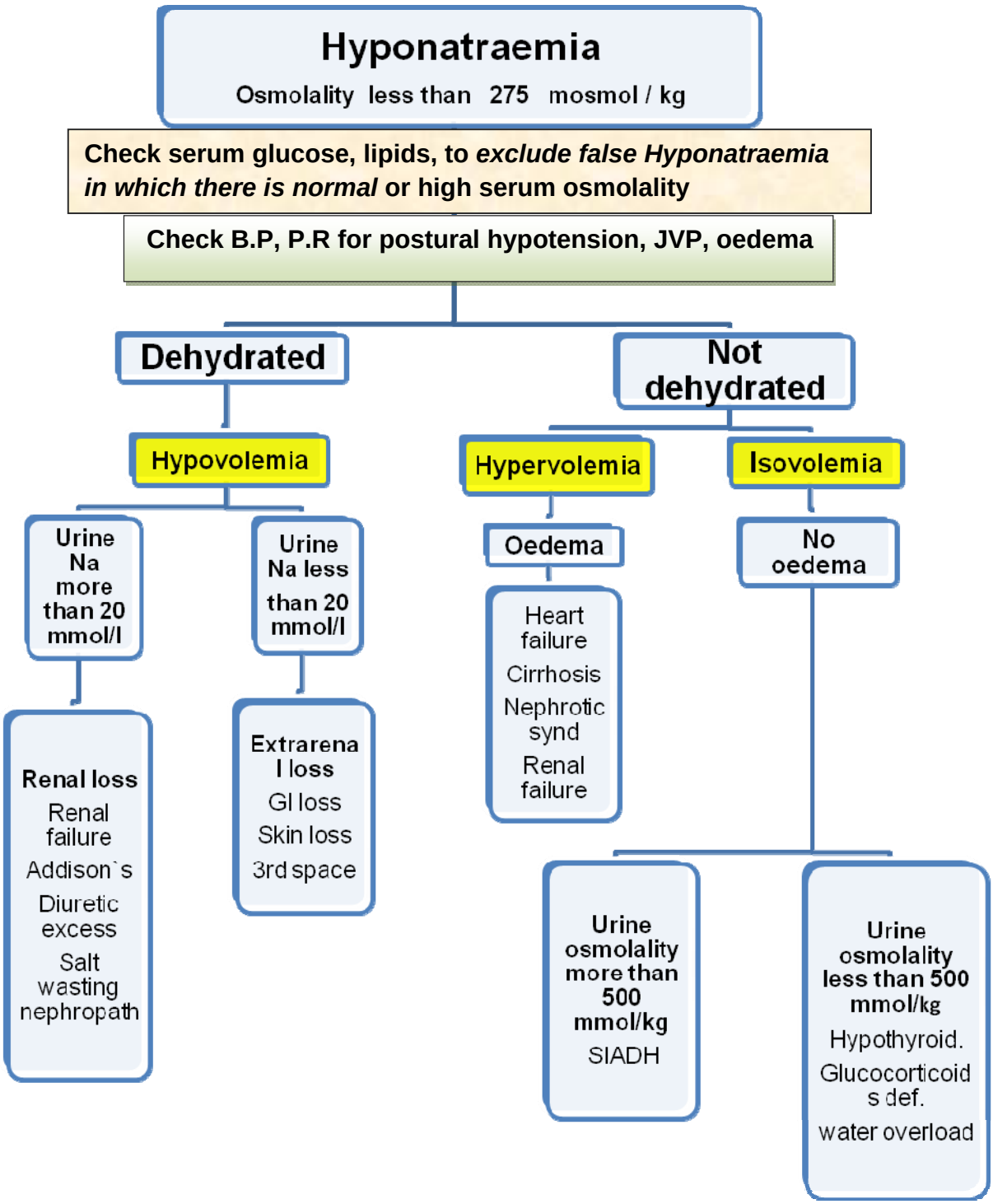

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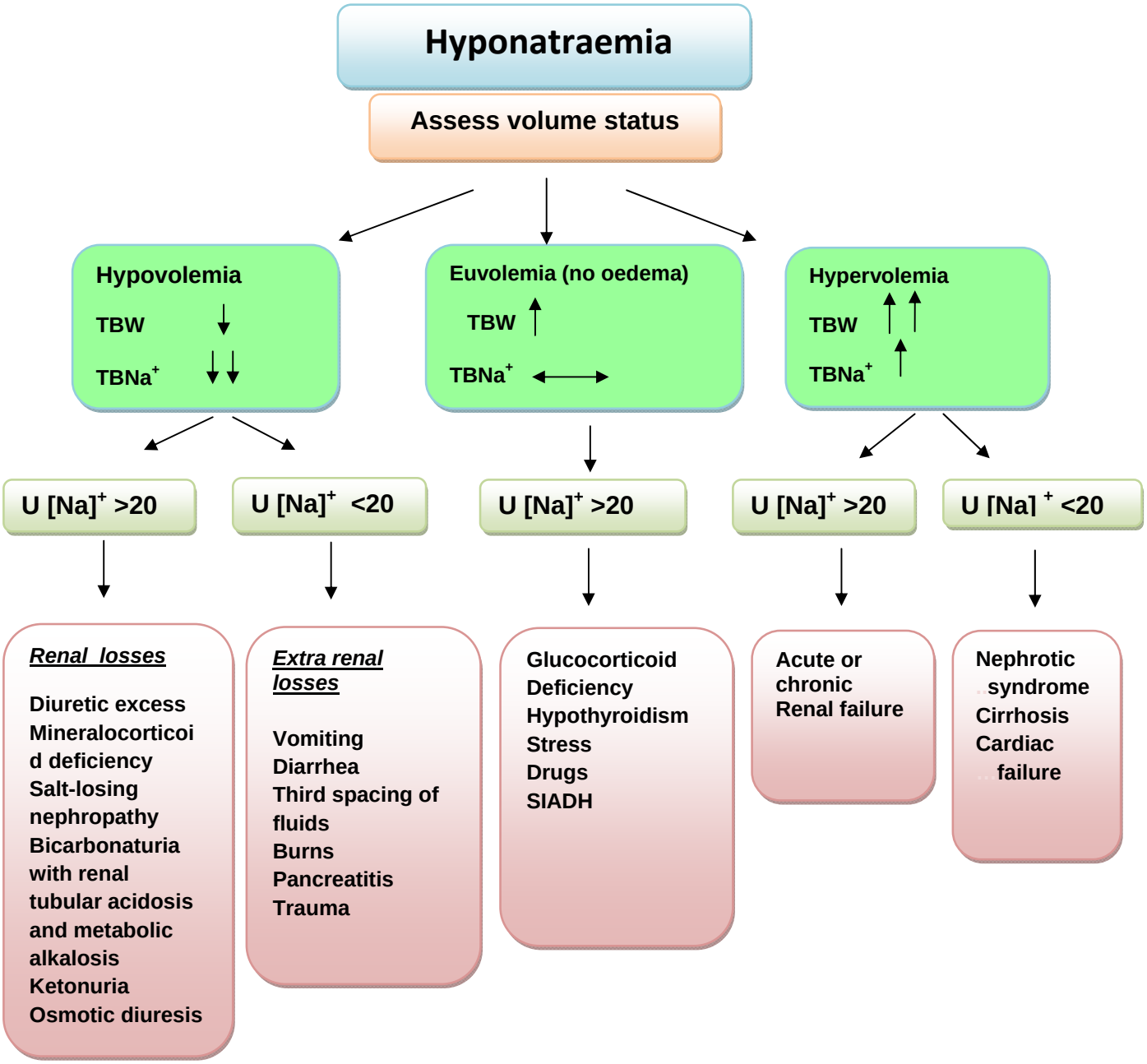
Hyponatraemia
Assess volume status
Hypovolemia
TBW
TBNa+
Euvolemia (no oedema)
TBW
TBNa+
Hypervolemia
TBW
TBNa+
U [Na]+ >20
U [Na]+ <20
U [Na]+ >20
U [Na]+ >20
U [Na] + <20
Renal losses
Diuretic excess
Mineralocorticoid deficiency
Salt-losing nephropathy
Bicarbonaturia with renal tubular acidosis and metabolic alkalosis
Ketonuria
Osmotic diuresis
Extra renal losses
Vomiting
Diarrhea
Third spacing of fluids
Burns
Pancreatitis
Trauma
Glucocorticoid Deficiency
Hypothyroidism
Stress
Drugs
SIADH
Acute or chronic Renal failure
Nephrotic syndrome
Cirrhosis
Cardiac failure