Electrolyte Imbalance

Sodium and Water abnormalities

- Hyponatremia- S.Na < 135 meq/l.
- Hypernatremia- S.Na > 145 meq/l.

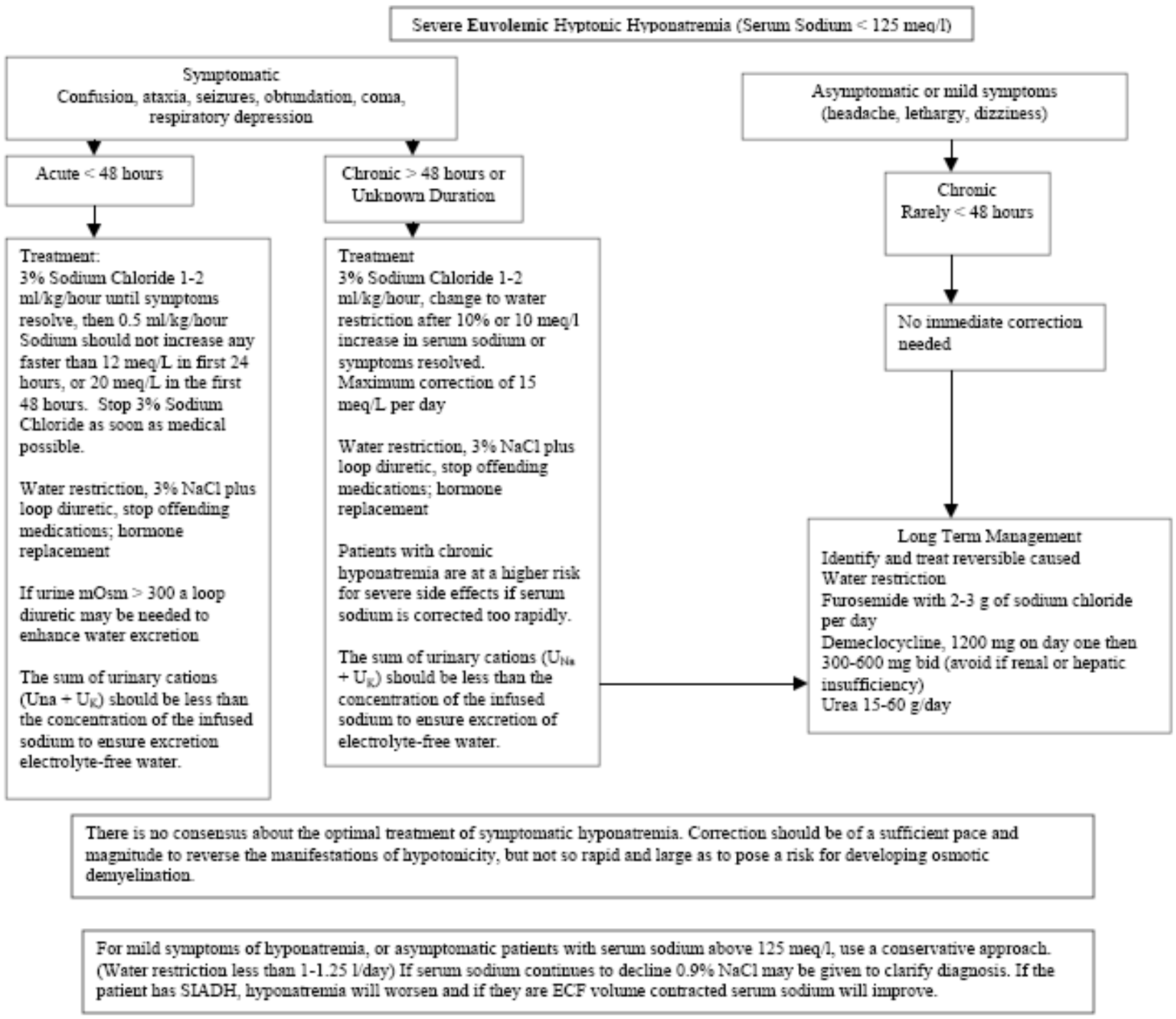
Tools for evaluation of Hyponatremic patient

- History
- Physical examination

} Idea about obvious cause and Volume status

- Lab tests
  - S. Osmolality
  - U. Osmolality
  - Urine electrolytes (Na+, K+, Cl-)

- Response to Isotonic saline volume expansion



Hypernatremia

- S.Na+ > 145 meq/l
- reflects serum hyperosmolarity

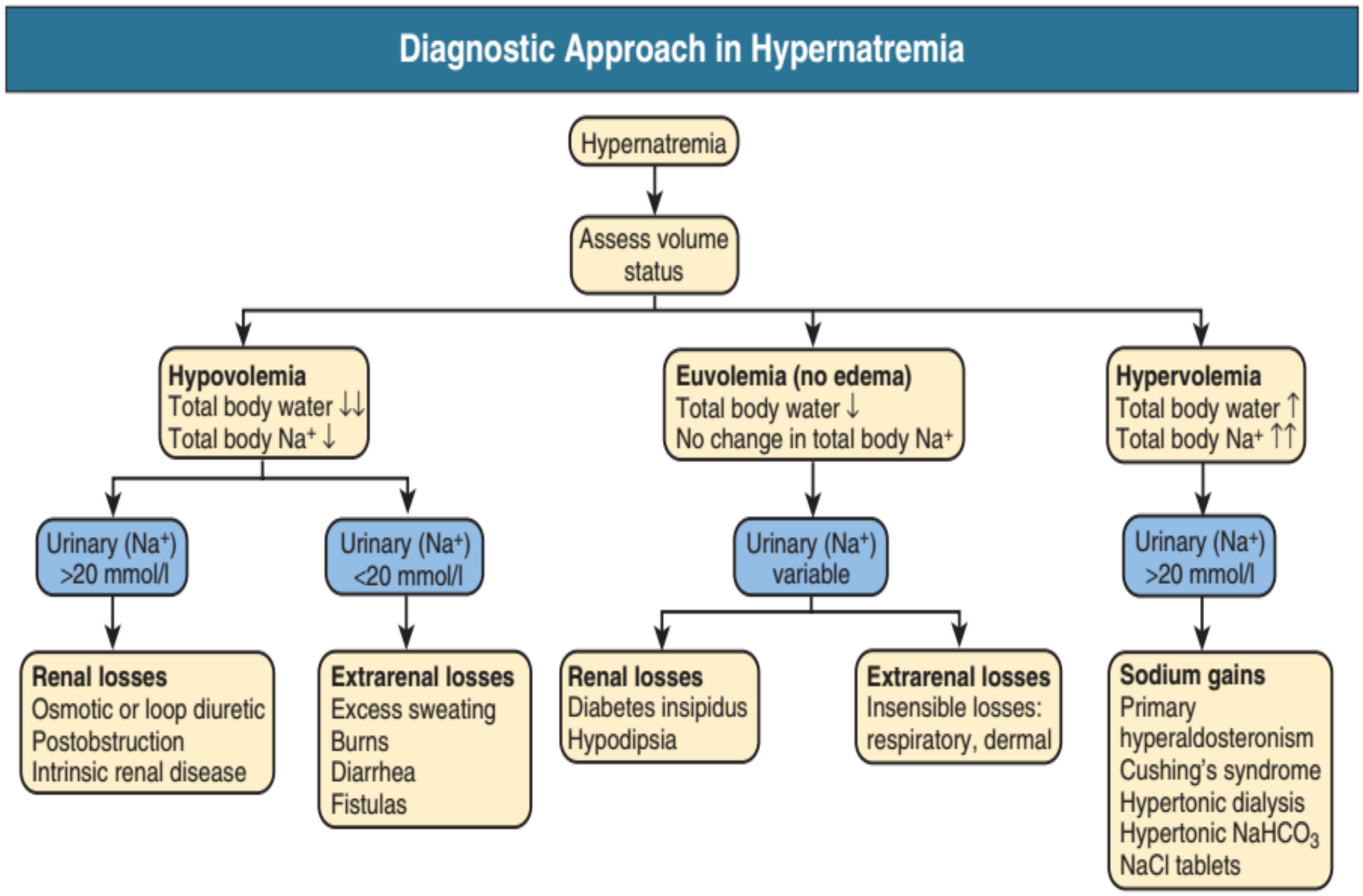
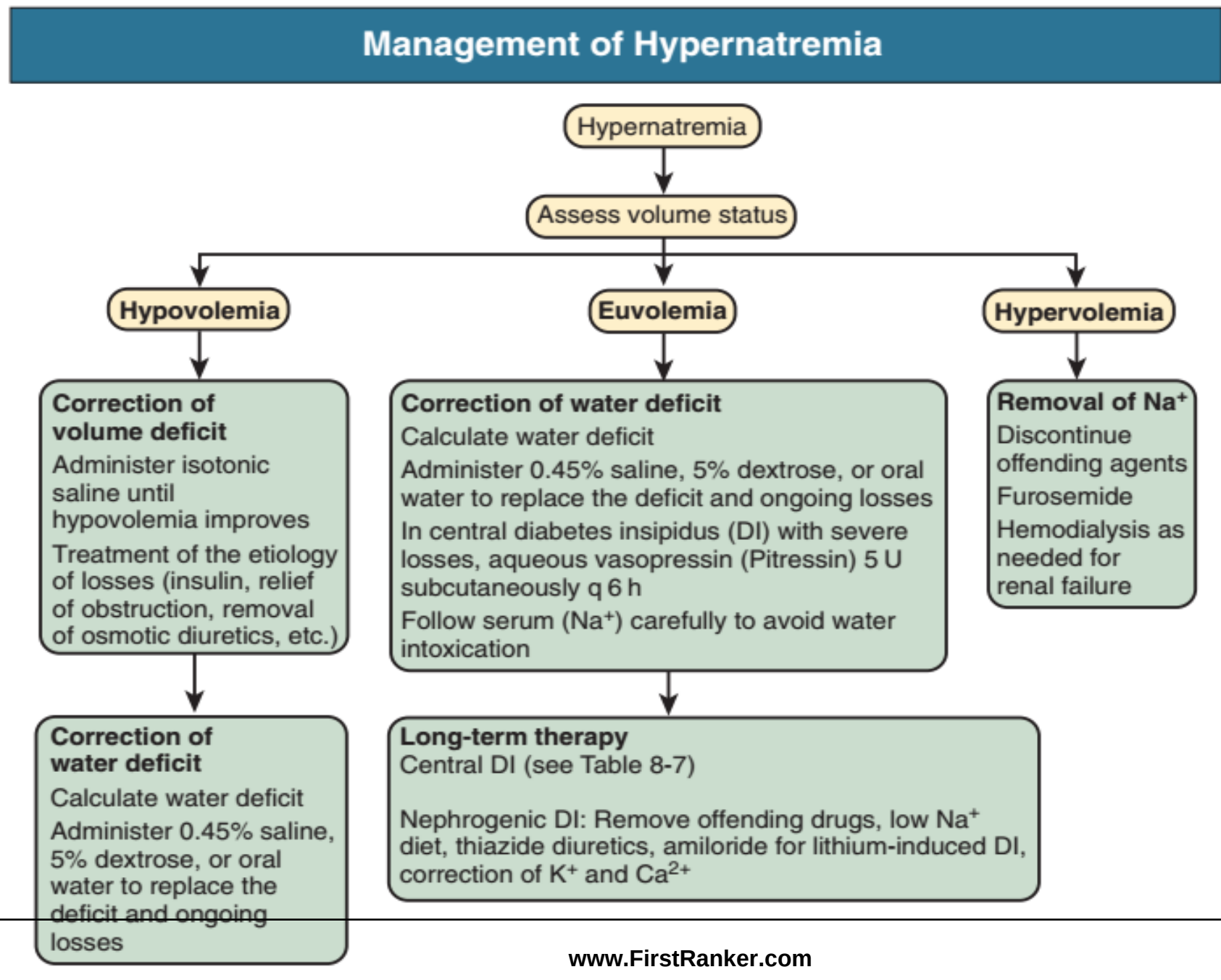


Figure 8-10 **Algorithm for diagnostic assessment of the patient with hypernatremia.** *(Modified from reference 5.)*



- In the normal man, total body water is approximately 60% of body weight (50% in women and obese individuals). With hyponatremia or hypernatremia, the change in total body water can be calculated from the serum Na+ concentration by the following formula:
- Water excess = 0.6W X (1 – [Na+]obs/140)
- Water deficit = 0.6W X ([Na+]obs/140 – 1)
- obs is observed sodium concentration (in mmol/l) and W is body weight (in kilograms).

Hyperkalemia

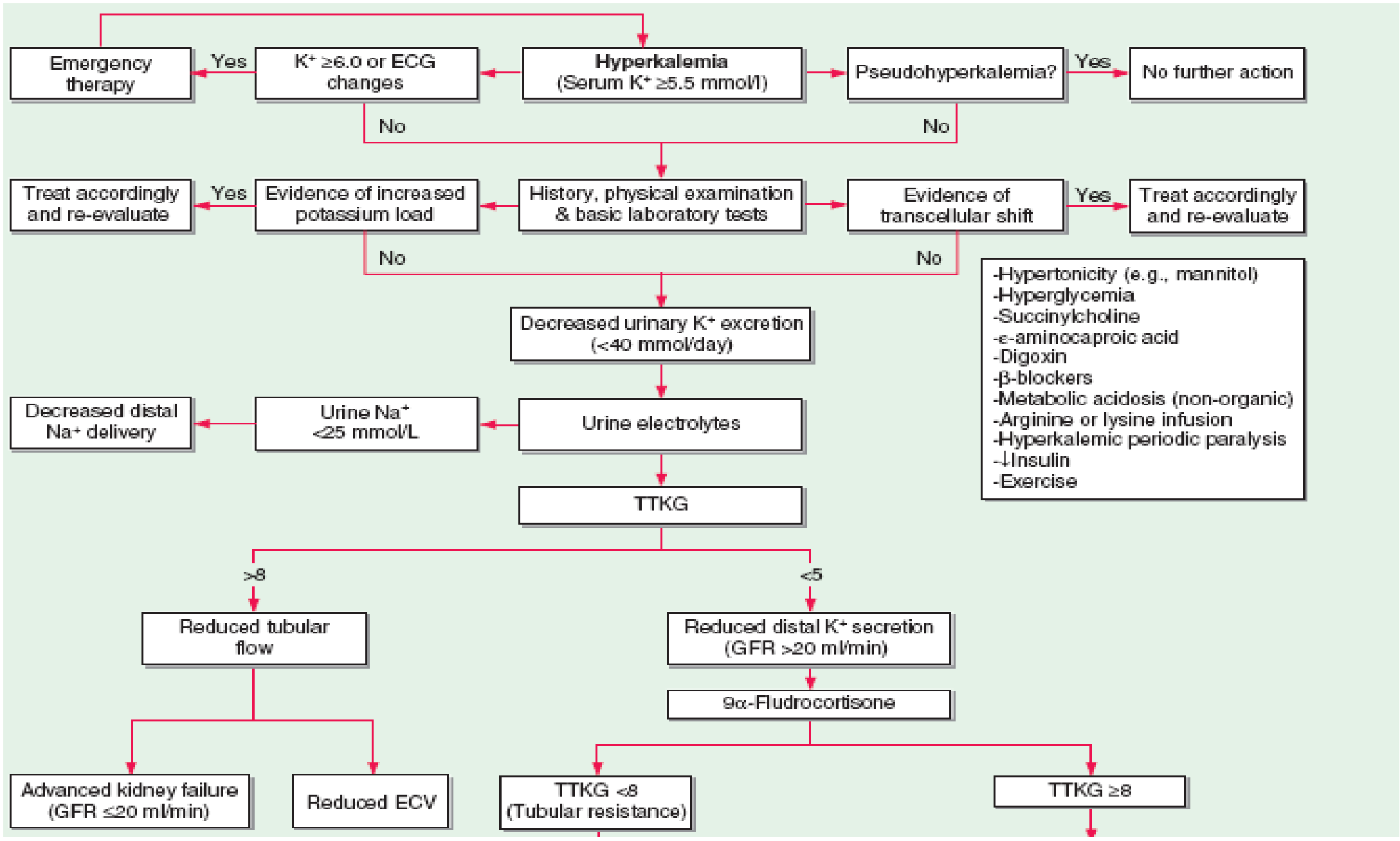
- S.K+ > 5.5 meq/L

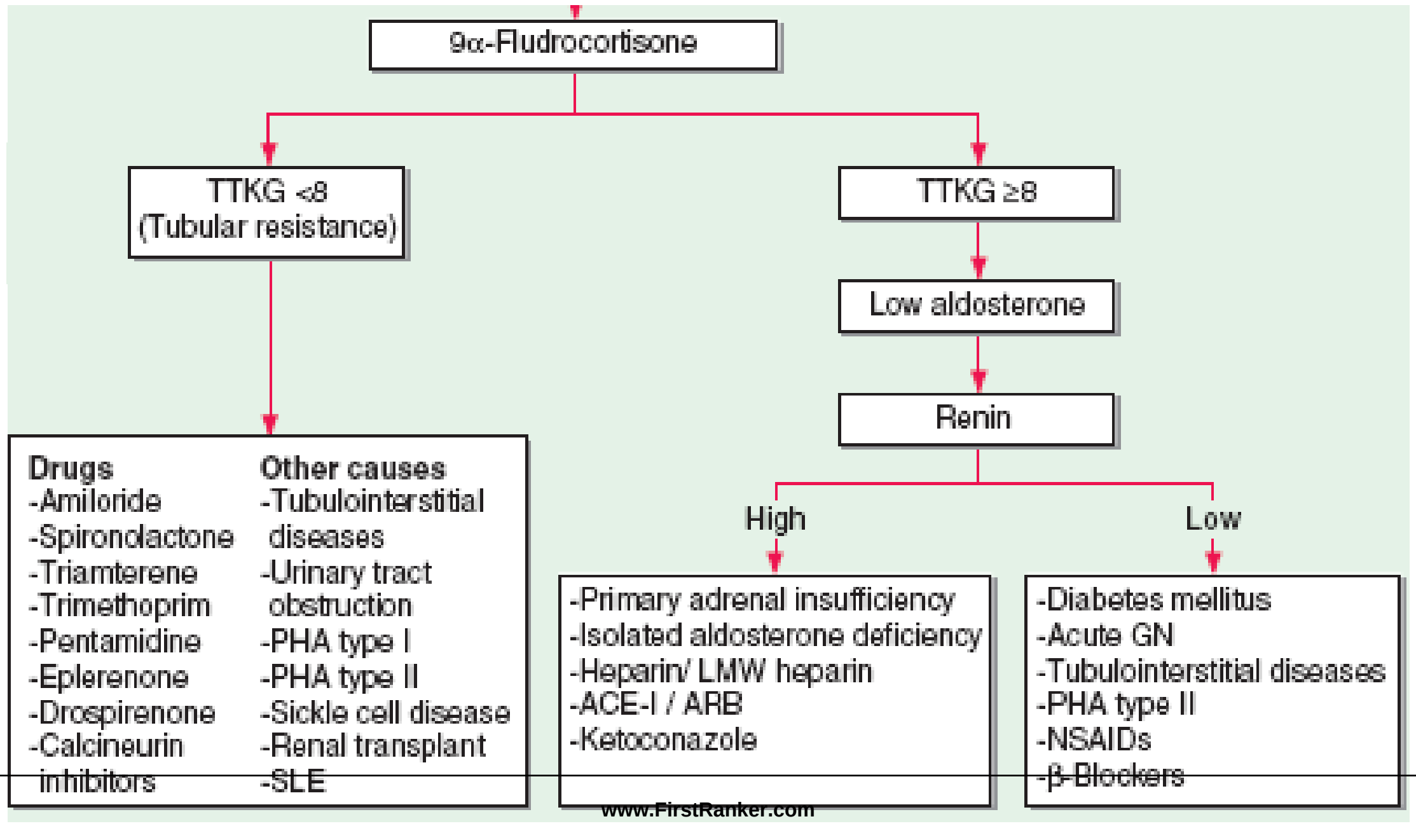
Serum K^+ Concentration (mmol/L)	Electrocardiographic Abnormality
5.5-6.5	Tall peaked T waves with narrow base, best seen in precordial leads
6.5-8.0	Peaked T waves Prolonged PR interval Decreased amplitude of P waves Widening of QRS complex
>8.0	Absence of P waves Intraventricular blocks, fascicular blocks, bundle branch blocks, QRS axis shift Progressive widening of the QRS complex Sine wave pattern (sinoventricular rhythm), ventricular fibrillation, asystole

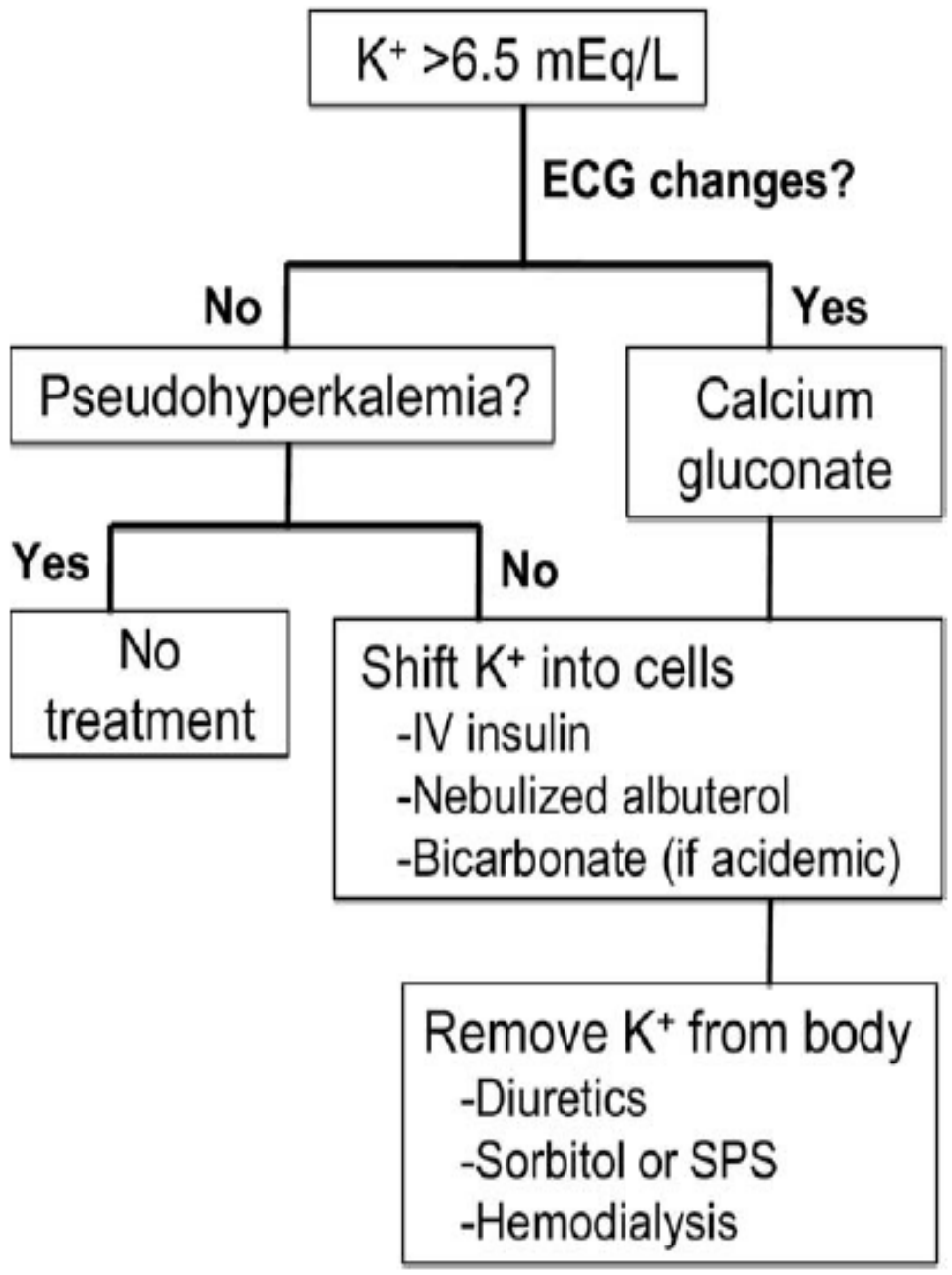
Transtubular Potassium Gradient

TTKG is a measurement of net K^+ secretion by the distal nephron after correcting for changes in urinary osmolality and is often used to determine whether hyperkalemia is caused by aldosterone deficiency/resistance or whether the hyperkalemia is secondary to nonrenal causes. As with all diagnostic aids, clinical correlation is indicated, and potassium intake should be assessed.

$TTKG = (K_u/K_s) \times (S_{osm}/U_{osm})$, where K_u and K_s are the concentration of K^+ in urine and serum, respectively, and U_{osm} and S_{osm} are the osmolalities of urine and serum, respectively.







Hypokalemia

- S.Potassium < 3.5 meq/l

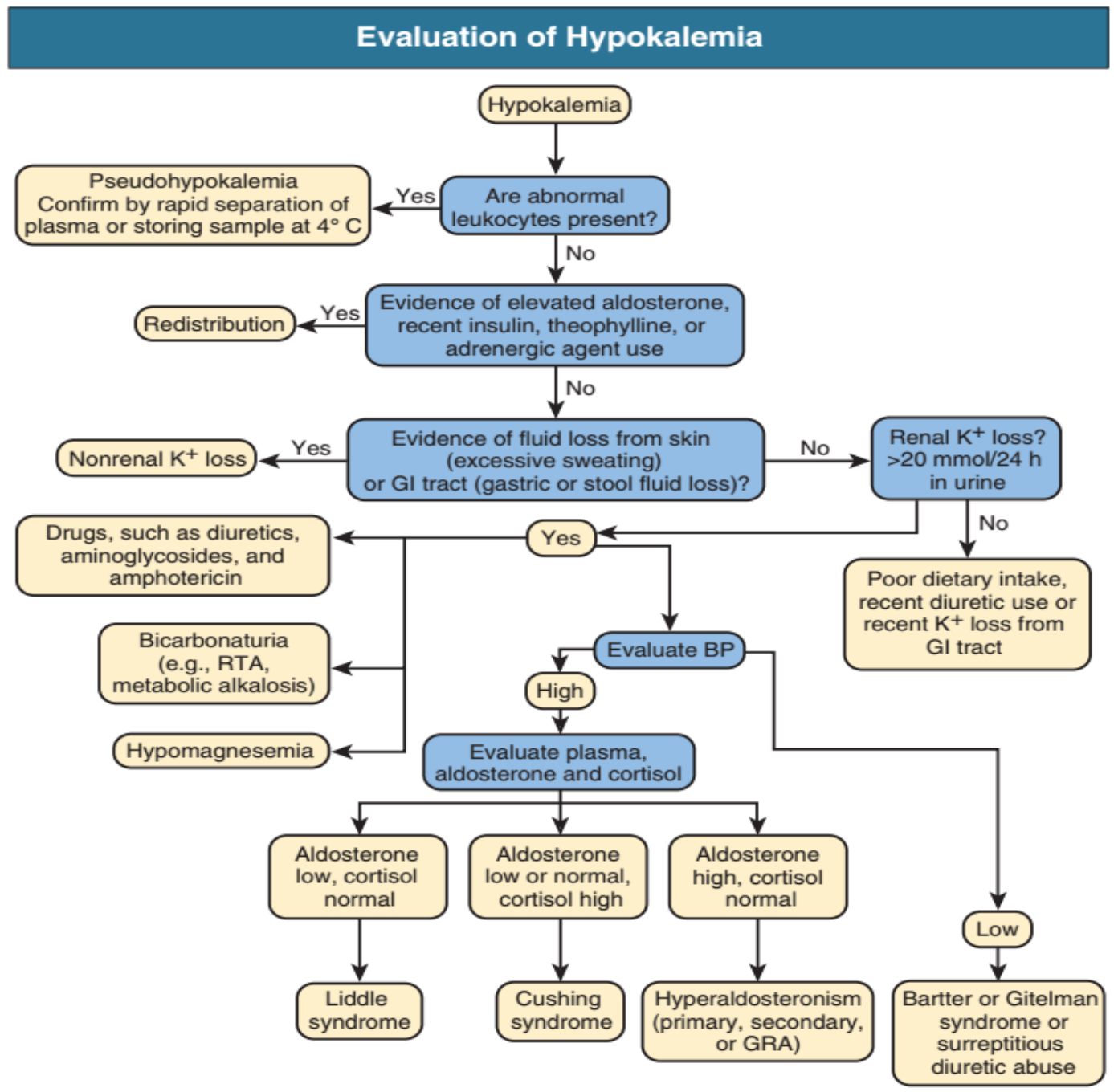


Figure 9-4 Diagnostic evaluation of hypokalemia. *BP,* Blood pressure; *GI,* gastrointestinal; *GRA,* glucocorticoid-remediable aldosteronism; *RTA,* renal tubular acidosis.

Treatment

- Potassium replacement can be given through the intravenous (IV) or oral (PO) route.
- Oral or enteral administration is preferred if the patient can take oral medication and has normal GI tract function.
- When potassium is given intravenously, acute hyperkalemia can occur if the IV rate is too rapid and can cause sudden cardiac death.
- IV replacement can be given safely at a rate of 10 mmol KCl/h.
- IV administration of 20 mmol KCl typically increases the serum potassium by about 0.25 mmol/l.
- If more rapid replacement is necessary, 20 or 40 mmol/h can be administered through a central venous catheter, but continuous ECG monitoring should be used under these circumstances.