Table 2-4
ELECTROLYTES: SODIUM

Hypernatremia (Na^+ > 147 mEq/L)	
Common Causes	**Manifestations**
• Hypovolemia/poor water intake • Excess Na^+ intake/hypertonic IV solutions • Severe vomiting • CHF • Renal insufficiency and failure • Cushing syndrome • Diabetes insipidus	• Irritability/agitation • Seizure, coma • Hypotension • Tachycardia • Weak, thready pulse • Decreased urine output
Hyponatremia (Na^+ < 135 mEq/L)	
Common Causes	**Manifestations**
• Hypovolemia: ¤ Diuretic use ¤ GI loss ¤ Burns/wound drainage ¤ Adrenal insufficiency • Hypervolemia: ¤ Hypotonic IV fluids ¤ CHF ¤ Cirrhosis ¤ Renal failure ¤ Syndrome of inappropriate antidiuretic hormone (SIADH)	• Headache • Lethargy, confusion • Absent/diminished reflexes • Seizures, coma • Nausea/vomiting • Diarrhea • Hypovolemic hyponatremia: ¤ Poor skin turgor ¤ Dry mucus membranes ¤ Orthostatic hypotension, tachycardia, weak pulse • Hypervolemic hyponatremia: ¤ HTN, tachycardia ¤ Pitting edema

Hypokalemia, low potassium (<3.5 mEq/L), or potassium deficiency, usually occurs due to loss of body potassium (eg, diarrhea, vomiting), reduced intake (ie, malnutrition), or increased cellular uptake. Hormones that promote a shift of potassium from the extracellular fluid into the intracellular fluid are insulin and the catecholamines, norepinephrine and epinephrine. Aldosterone increases renal excretion of potassium in the urine.[1] Hypokalemia hyperpolarizes cells, making the cell membrane potential more negative. This decreases the excitability of cells, necessitating greater stimuli for formation of action potentials. The clinical manifestations of hypokalemia include muscle weakness and conduction abnormalities (see Table 2-5).[1]

Hyperkalemia, elevated potassium (>5.5 mEq/L), is rare due to efficient renal excretion and cellular uptake. Causes of hyperkalemia include increased potassium intake combined with renal insufficiency and shifts of potassium from the intracellular fluid to the extracellular fluid due to cellular damage (eg, hypoxia, acidosis, muscle damage, burns) and insulin deficiency (type 1 diabetes). Medications, including heparin, potassium sparing diuretics, nonsteroidal anti-inflammatory drugs (NSAIDs), angiotensin converting enzyme (ACE) inhibitors, and beta blockers, can lead to hyperkalemia.[3-5]