

Electrolyte SS

Intravenous fluids and how they work in the body to maintain homeostasis and fluid balance

- **Isotonic solutions**
 - When the solutions on both sides of a selectively permeable membrane have established equilibrium or are equal in concentration, they are isotonic
 - Isotonic solutions are isotonic to human cells, and thus very little osmosis occurs; isotonic solutions have the same osmolality as body fluids
 - increase extracellular fluid volume
 - Do not enter the cells because no osmotic force exists to shift the fluids
 - 0.9% sodium chloride (normal saline), 5% dextrose in water (D5W), 5% dextrose in 0.225% saline (D5W/ ¼ NS), Lactated Ringer's (LR)
- **Hypotonic solutions**
 - When a solution contains a lower concentration of salt or solute than another more concentrated solution, it is considered hypotonic
 - A hypotonic solution has less salt or more water than an isotonic solution; these solutions have lower osmolality than body fluids
 - Hypotonic solutions are hypotonic to the cells; therefore osmosis would continue in an attempt to bring about balance or equality
 - Cause the movement of water into cells by osmosis
 - Should be administered slowly to prevent cellular edema
 - 0.45% sodium chloride (½ NS), 0.225% sodium chloride (¼ NS), 0.33% sodium chloride (1/3 NS)
- **Hypertonic solutions**
 - A solution that has a higher concentration of solutes than another less concentrated solution is hypertonic; these solutions have higher osmolality than body fluids
 - Concentrate extracellular body fluid and cause movement of water from cells into the extracellular fluid by osmosis
 - 3% sodium chloride (3% NS), 5% sodium chloride (5% NS), 10% dextrose in water (D10W), 5% dextrose in 0.9% sodium chloride (D5W/NS), 5% dextrose in 0.45% sodium chloride (D5W/ ½ NS), 5% dextrose in Lactated Ringer's (D5LR)

Examples of various intravenous fluids

- 0.9% sodium chloride (normal saline)
- 5% dextrose in water (D5W)
- 5% dextrose in 0.225% saline (D5W/ ¼ NS)
- Lactated Ringer's (LR)
- 0.45% sodium chloride (½ NS)
- 0.225% sodium chloride (¼ NS)
- 0.33% sodium chloride (1/3 NS)
- 3% sodium chloride (3% NS)
- 5% sodium chloride (5% NS)
- 10% dextrose in water (D10W)
- 5% dextrose in 0.9% sodium chloride (D5W/NS)
- 5% dextrose in 0.45% sodium chloride (D5W/NS)
- 5% dextrose in 0.45% sodium chloride (D5W/ ½ NS)
- 5% dextrose in Lactated Ringer's (D5LR)

Key nursing assessments of symptoms related to critical electrolyte imbalances (Na⁺/K⁺)

- **Hyponatremia**

- Cardiovascular
 - Symptoms may vary with changes in vascular volume
 - Normovolemic: rapid pulse rate, normal blood pressure
 - Hypovolemic: thread, weak, rapid pulse rate, hypotension, flat neck veins, normal or low central venous pressure
 - Hypervolemic: rapid, bounding pulse, blood pressure normal or elevated, normal or elevated central venous pressure
- Respiratory
 - Shallow, ineffective respiratory movement is a late manifestation related to skeletal muscle weakness
- Neuromuscular
 - Generalized skeletal muscle weakness that is worse in the extremities, diminished deep tendon reflexes
- Central Nervous System
 - Headache, personality changes, confusion, seizures, coma
- Gastrointestinal
 - Increased motility and hyperactive bowel sounds, nausea, abdominal cramping and diarrhea
- Renal
 - Increased urinary output
- Integumentary
 - Dry mucous membranes
- Laboratory findings
 - Serum sodium level less than 135 mEq/L, decreased urinary specific gravity
- **Hypernatremia**
 - Cardiovascular
 - Heart rate and blood pressure responds to vascular volume status
 - Respiratory
 - Pulmonary edema if hypervolemia is present
 - Neuromuscular
 - Early: spontaneous muscle twitches , irregular muscle contractions
 - Late: skeletal muscle weakness, deep tendon reflexes diminishes or absent
 - Central Nervous System
 - Altered cerebral function is the most common manifestation of hypernatremia
 - Normovolemia or hypovolemia: agitation, confusion, seizures
 - Hypervolemia: lethargy, stupor, coma
 - Gastrointestinal
 - Extreme thirst
 - Renal
 - Decreased urinary output
 - Integumentary
 - Dry and flushed skin, dry and sticky tongue and mucous membranes, presence or absence of edema – depending on fluid volume changes
 - Laboratory findings
 - Serum sodium level that exceeds 145 mEq/L, increased urinary specific gravity
- **Hypokalemia**
 - Cardiovascular
 - Thread, weak, irregular pulse, weak peripheral pulses, orthostatic hypotension
 - Respiratory
 - Shallow, ineffective respirations that result from profound weakness of the skeletal muscles of respiration, diminished breath sounds
 - Neuromuscular

- Anxiety, lethargy, confusion, coma, skeletal muscle weakness, eventual flaccid paralysis, loss of tactile discrimination, paresthesias, deep tendon hyporeflexia
 - Gastrointestinal
 - Decreased mobility, hypoactive to absent bowel sounds, nausea, vomiting, constipation, abdominal distention, paralytic ileus
 - Laboratory findings
 - Serum potassium level lower than 3.5 mEq/L, electrocardiogram changes: ST depression, shallow, flat or inverted T wave, and prominent wave
- **Hyperkalemia**
 - Cardiovascular
 - Slow, weak, irregular heart rate, decreased blood pressure
 - Respiratory
 - Profound weakness of the skeletal muscles leading to respiratory failure
 - Neuromuscular
 - Early: muscle twitches, cramps, paresthesias (tingling and burning followed by numbness in the hands and feet and around the mouth)
 - Late: profound weakness, ascending flaccid paralysis in the arms and legs (trunk, head and respiratory muscles become affected when the serum potassium level reaches a lethal level)
 - Gastrointestinal
 - Increased motility, hyperactive bowel sounds, diarrhea
 - Laboratory findings
 - Serum potassium level that exceeds 5.1 mEq/L, electrocardiographic changes: tall peaked T waves, flat P waves, widened QRS complexes, and prolonged PR intervals
- **Hypocalcemia**
 - Cardiovascular
 - Decreased heart rate, hypotension, diminished peripheral pulses
 - Respiratory
 - Not directly affected, however, respiratory failure or arrest can result from decreased respiratory movement because of muscle tetany or seizures
 - Neuromuscular
 - Irritable skeletal muscles: twitches, cramps, tetany, seizures, painful muscle spasms in the calf of the foot during periods of inactivity, paresthesias followed by numbness that may affect the lips, nose, and ears in addition to the limbs, positive Trousseau's and Chvostek's signs, hyperactive deep tendon reflexes, anxiety, irritability
 - *Chvostek's sign is contraction of facial muscles in response to a light tap over the facial nerve in the front ear*
 - *Trousseau's sign is a carpal spasm induced by inflating a blood pressure cuff above the systolic pressure for a few minutes*
 - Renal
 - Urinary output varies depending on the cause
 - Gastrointestinal
 - Increased motility, hyperactive bowel sounds, cramping, diarrhea
 - Laboratory findings
 - Serum calcium level less than 8.6 mg/dL, electrocardiographic changes: prolonged ST interval, prolonged QT interval
- **Hypercalcemia**
 - Cardiovascular
 - Increased heart rate in the early phase, bradycardia that can lead to cardiac arrest in late phases, increased blood pressure, bounding, full peripheral pulses
 - Respiratory
 - Ineffective respiratory movement as a result of profound skeletal muscle weakness

- Neuromuscular
 - Profound muscle weakness, diminished or absent deep tendon reflexes, disorientation, lethargy, coma
- Renal
 - Urinary output varies depending on the cause, formation of renal calculi, flank pain
- Gastrointestinal
 - Decreased motility and hyperactive bowel sounds, anorexia, nausea, abdominal distention, constipation
- Laboratory findings
 - Serum calcium level that exceeds 10 mg/dL, electrocardiographic changes; shortened ST segment, widened T wave
- **Hypomagnesia**
 - Cardiovascular
 - Tachycardia, hypertension
 - Respiratory
 - Shallow respirations
 - Neuromuscular
 - Twitches, paresthesias, positive Trousseau's and Chvostek's signs, hyperreflexia, tetany, seizures
 - Central Nervous System
 - Irritability, confusion
 - Laboratory findings
 - Serum magnesium level is less than 1.6 mg/dL, electrocardiographic changes: tall T waves, depressed ST segments
- **Hypermagnesia**
 - Cardiovascular
 - Bradycardia, dysrhythmias, hypotension
 - Respiratory
 - Diminished or absent deep tendon reflexes, skeletal muscle weakness
 - Central Nervous System
 - Drowsiness and lethargy that progresses to coma
 - Laboratory findings
 - Serum magnesium level that exceeds 2.5. mg/dL, electrocardiographic changes: prolonged PR interval, widened QRS complexes

Key physical assessments related to s/sx of hypovolemia and hypervolemia

- **Fluid Volume Deficit (hypovolemia)**
 - Cardiovascular
 - Thready, increased pulse rate, decreased blood pressure and orthostatic hypotension, flat neck and hand in veins in dependant positions, diminished peripheral pulses, decreased central venous pressure, dysrhythmias
 - Respiratory
 - Increased rate and depth of respirations, dysnea
 - Neuromuscular
 - Decreased central nervous system activity, from lethargy to coma, fever, depending on the amount of fluid loss, skeletal muscle weakness
 - Renal
 - Decreased urine output
 - Integumentary
 - Dry skin, poor turgor, tenting, dry mouth
 - Gastrointestinal

- Decreased motility and diminished bowel sounds, constipation, thirst, decreased body weight
 - Laboratory findings
 - Increased serum osmolality, increased hematocrit, increased blood urea nitrogen (BUN) level, increased serum sodium level, increased urinary specific gravity
- **Fluid Volume Excess (hypervolemia)**
 - Cardiovascular
 - Bounding, increased pulse rate, elevated blood pressure, distended neck and hand veins, elevated central venous pressure, dysrhythmias
 - Respiratory
 - Increased respiratory rate (shallow respirations), dyspnea, moist crackles on auscultation
 - Neuromuscular
 - Altered level of consciousness, headache, visual disturbances, skeletal muscle weakness, paresthesias
 - Renal
 - Increased urine output if kidneys cannot compensate; decreased urine output if kidney damage is the cause
 - Integumentary
 - Pitting edema in independent areas, pale cool skin
 - Gastrointestinal
 - Increased motility in gastrointestinal tract, diarrhea, increased body weight, liver enlargement, ascites
 - Laboratory findings
 - Decreased serum osmolality, decreased hematocrit, decreased BUN level, decreased serum sodium level, decreased urine specific gravity

Key physical assessments related to a post-op pt.

- **Respiratory system**
 - Assess breath sounds – stridor, wheezing, or crowing sound can indicate partial obstruction, bronchospasm, or laryngospasm, crackles or rhonci may indicate pulmonary edema
 - Monitor vital signs
 - Monitor airway patency and ensure adequate ventilation
 - Remember that extubated patients who are lethargic may not be able to maintain an airway
 - Monitor for secretions; if the client is unable to clear the airway by coughing, suction the secretions from the patient’s airway
 - Observe chest movement for symmetry and the use of accessory muscles
 - Monitor oxygen administration if prescribed
 - Monitor pulse oximetry
 - Encourage deep breathing and coughing exercises as soon as possible after surgery
 - Note the rate, depth and quality of respirations; the respiratory rate should be greater than 10 and less than 30 breaths/min.
 - Monitor for signs of respiratory distress, atelectasis, or other respiratory complications
- **Cardiovascular system**
 - Monitor circulatory status, such as skin color, peripheral pulses, capillary refill, and for the absence of edema, numbness and tingling
 - Monitor for bleeding
 - Assess the pulse for rate and rhythm (a bounding pulse may indicate hypertension, fluid overload, or patient anxiety)
 - Monitor for signs of hypertension
 - Monitor for cardiac dysrhythmias

- Monitor for signs of thrombophlebitis, particularly in clients who were in the lithotomy position during surgery
- Encourage the use of antiembolism stockings, if prescribed, to promote venous return, strengthen muscle tone, and prevent pooling of blood in the extremities
- **Musculoskeletal system**
 - Assess the client for movement of the extremities
 - Review physician's prescriptions regarding client positioning or restrictions
 - Encourage ambulation if prescribed; before ambulation, instruct the patient to sit at the edge of the bed with his or her feet supported to assume balance
 - Unless contraindicated, place the patient in a low Fowler's position after surgery to increase the size of the thorax for lung expansion
 - Avoid positioning of the postoperative patient in a supine position until pharyngeal reflexes have returned; if the patient is comatose or semicomatose, position on the side (additionally, an oral airway may be needed)
 - If client is unable to get out of bed, turn the client every 1 to 2 hours
- **Neurological system**
 - Assess level of consciousness
 - Make frequent periodic attempts to awaken the client until the client awakens
 - Orient the client to the environment
 - Speak in a soft tone; filter out extraneous noises in the environment
 - Maintain the client's body temperature and prevent heat loss by providing the patient with warm blankets and raising the room temperature as necessary
 - Temperature control
 - Monitor temperature
 - Monitor for signs of hypothermia that may result from anesthesia, a cool operation room, or exposure of skin and internal organs during surgery
 - Apply warm blankets and continue oxygen as prescribed if the client experiences shivering
- **Integumentary system**
 - Assess surgical site, drains and wound dressings (serous drainage may occur from an incision, but if excessive bleeding occurs from the site, notify the physician)
 - Assess the skin for redness, abrasions, or breakdown that may have resulted from surgical positioning
 - Monitor body temperature and wound for signs of infection
 - Maintain a dry, intact dressing
 - Change dressings as prescribed, noting the amount of bleeding or drainage, odor, and intactness of sutures or staples
 - Wound drains should be patent; prepare to assist with the removal of drains (as prescribed by the physician) when the drainage amount becomes insignificant
 - An abdominal binder may be prescribed for obese and debilitated individuals to prevent dehiscence of the incision
- **Fluid electrolyte balance**
 - Monitor IV fluid administration as prescribed
 - Record intake and output
 - Monitor for signs of fluid electrolyte imbalances
- **Gastrointestinal system**
 - Monitor intake and output for nausea and vomiting
 - Maintain patency of the nasogastric tube if present
 - Monitor for abdominal distention
 - Monitor for passage of flatus and return of bowel sounds
 - Administer frequent oral care, at least every 2 hours
 - Maintain the NPO status until the gag reflex and peristalsis return
 - When oral fluids are permitted, start with ice chips and water