PYRAMID POINTS

MODULE 09:
FLUIDS AND ELECTROLYTES
I. Concepts of Fluid and Electrolyte Balance

- **Electrolytes**
  - Potassium, sodium, chloride, calcium, magnesium, phosphorus

- **Body fluid compartments**
  - Intracellular, extracellular, intravascular, interstitial compartments

- **Third-spacing**
  - Accumulation and sequestration of trapped extracellular fluid in actual or potential body space; in other words, movement of fluid from intravascular compartment to interstitial tissue or other body space

- **Edema**
  - Excess accumulation of fluid in interstitial tissue
  - Generalized edema referred to as anasarca
I. Concepts of Fluid and Electrolyte Balance (continued)

- **Body fluid**
  - Infants and older adults at higher risk than younger adults for fluid-related problems

- **Body fluid transport**
  - Diffusion, osmosis, filtration, hydrostatic pressure

- **Movement of body fluid**
  - Across semipermeable cell membrane

- **Body fluid excretion**
  - Through skin, lungs, gastrointestinal (GI) tract, kidneys

I. Concepts of Fluid and Electrolyte Balance (continued)

- Body fluid replacement
  - Orally ingested liquids
  - Water in foods
  - Water formed by oxidation of foods

- Maintaining fluid and electrolyte balance
  - Kidneys, adrenal glands play major role
  - Antidiuretic hormone from pituitary gland regulates osmotic pressure of extracellular fluid by regulating amount of water reabsorbed by kidneys
II. Fluid Volume Deficit

- **Description**
  - Dehydration occurs when fluid intake of the body is insufficient to meet fluid needs of body

- **Types of fluid volume deficits**
  - Isotonic dehydration: water and electrolytes are lost in equal proportions
  - Hypotonic dehydration: electrolyte loss exceeds water loss
  - Hypertonic dehydration: water loss exceeds electrolyte loss

- **Causes of fluid volume deficits**
  - Hemorrhage
  - Excessive perspiration
  - Hyperventilation
  - Prolonged fever, vomiting, and diarrhea
  - End-stage renal failure
  - Diabetes insipidus
II. Fluid Volume Deficit (continued)

- **Assessment**
  - Tachycardia
  - Hypotension
  - Tachypnea
  - Lethargy to coma state
  - Oliguria
  - Nonelastic skin turgor
  - Dry skin
  - Mucous membranes
  - Decreased bowel sounds
  - Constipation
  - Thirst

- **Interventions**
  - Rehydrate client as prescribed
  - Administer medications to correct cause(s) as prescribed
III. Fluid Volume Excess

- **Description**
  - Fluid intake or fluid retention exceeds fluid needs of the body

- **Types**
  - Isotonic overhydration
    - Excessive fluid in extracellular fluid compartment
  - Hypertonic overhydration
    - Rare, but may be caused by excessive sodium intake
  - Hypotonic overhydration
    - This is known as water intoxication
    - Excessive fluid moves into intracellular space and all body fluid compartments expand
III. Fluid Volume Excess (continued)

- Causes
  - Inadequately controlled intravenous (IV) therapy
  - Renal failure
  - Long-term corticosteroid therapy
  - Excessive sodium ingestion
  - Rapid infusion of hypertonic-hypotonic solutions
  - Excessive sodium bicarbonate therapy
  - Syndrome of inappropriate secretion of antidiuretic hormone (SIADH)
III. Fluid Volume Excess (continued)

- Data collection
  - Tachycardia
  - Hypertension
  - Distended neck veins
  - Tachypnea
  - Moist crackles
  - Altered level of consciousness
  - Pitting, dependent edema
  - Diarrhea
  - Ascites
  - Polyuria

- Interventions
  - Administer diuretics as prescribed
  - Restrict sodium and fluid intake as prescribed
IV. Hyponatremia

- **Description**
  - Serum sodium level less than 135 mEq/L

- **Causes**
  - Increased excretion
  - Inadequate intake
  - Diluted serum sodium

- **Data collection**
  - Changes in pulse and blood pressure, depending on vascular volume
  - Shallow respirations
  - Skeletal muscle weakness
  - Diminished deep tendon reflexes
  - Increased gastrointestinal motility, hyperactive bowel sounds
  - Polyuria
  - Decreased specific gravity
IV. Hyponatremia (continued)

- Interventions
  - Perform accurate monitoring of body systems related to impact of changes in serum sodium status
  - Increase daily dietary sodium intake as prescribed
    - Bacon, butter, canned foods, luncheon meats, table salt
V. Hypernatremia

- Description
  - Serum sodium level exceeds 145 mEq/L

- Causes
  - Decreased sodium excretion
  - Increased sodium intake
  - Decreased water intake
  - Increased water loss

- Data collection
  - Changes in pulse and blood pressure in response to vascular volume
  - Irregular muscle contractions
  - Diminished to absent deep tendon reflexes
  - Altered cerebral function
  - Increased specific gravity
  - Oliguria
  - Dry skin
Interventions

• Accurately monitor body systems to determine impact of changes in serum sodium status
• Administer IV fluids as prescribed if fluid loss is the cause
• Restrict sodium and fluid intake as prescribed
VI. Hypokalemia

- **Description**
  - Serum potassium level less than 3.5 mEq/L

- **Causes**
  - Total body potassium loss
  - Inadequate intake
  - Movement of potassium from extracellular to intracellular fluid
  - Dilution of serum potassium

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NURSING SCIENCES:
Fluids and Electrolytes
VI. Hypokalemia (continued)

- **Assessment**
  - Thready, weak pulses
  - Orthostatic hypotension
  - Changes in electrocardiogram (ECG), such as ST depression and flat or inverted T wave
  - Shallow respirations
  - Lethargy to coma state
  - Skeletal muscle weakness
  - Deep tendon hyporeflexia
  - Decreased GI motility
  - Polyuria
  - Decreased specific gravity
VI. Hypokalemia (continued)

- Interventions
  - Accurate monitoring of body systems related to impact of changes in serum potassium status
  - Take precautions when administering potassium IV
    - Maximum infusion rate should be 5 to 10 mEq/hr as prescribed
    - If client receiving more than 10 mEq/hr, place on cardiac monitor and infuse using IV controller
  - Instruct client not to take oral potassium supplements, if prescribed, on empty stomach
  - Instruct client about increasing dietary potassium with foods, such as bananas, fish, oranges, potatoes, meat, raisins, spinach, tomatoes
VII. Hyperkalemia

- **Description**
  - Serum potassium level exceeds 5.1 mEq/L

- **Causes**
  - Excessive intake
  - Decreased excretion
    - Potassium-sparing diuretics
  - Movement of potassium from intracellular to extracellular fluid

- **Data collection**
  - Slow, weak pulse
  - Hypotension
  - Changes in ECG, such as tall peaked T waves, widened QRS complexes, prolonged PR intervals
  - Respiratory failure secondary to severe muscle weakness
  - Muscle twitching changing to severe muscle weakness, with ascending flaccid paralysis
  - Increased GI motility
VII. Hyperkalemia (continued)

Interventions

- Hold IV potassium and oral supplements as prescribed
- Administer potassium-restricted diet as prescribed
- Administer medications to remove potassium, sodium polystyrene sulfonate (Kayexalate), if renal function impaired
VIII. Hypocalcemia

- **Description**
  - Serum calcium level lower than 8.6 mg/dL

- **Causes**
  - Inadequate oral intake
  - Lactose intolerance
  - Inadequate intake of vitamin D
  - Gastrointestinal wound drainage
  - Immobility
  - Removal or destruction of parathyroid glands
VIII. Hypocalcemia (continued)

- Data collection
  - Prolonged ST interval
  - Irritable skeletal muscles
  - Paresthesias
  - Positive Trousseau’s and Chvostek’s signs
  - Hyperactive deep tendon reflexes
  - Increased gastric activity
VIII. Hypocalcemia (continued)

- Interventions
  - Precautions when administering IV
    - Warm injection to body temperature before administration
    - Administer slowly
    - Monitor for changes in ECG
    - Observe for infiltration
    - Monitor for signs of hypercalcemia
  - Reduce environmental stimuli
  - Initiate seizure precautions
  - Monitor for symptoms of fracture
  - Keep calcium gluconate available
  - Dietary changes include increasing such foods as cheese, milk, soy milk, sardines, spinach, tofu, low-fat yogurt
IX. Hypercalcemia

- **Description**
  - Serum calcium level exceeds 10 mg/dL

- **Causes**
  - Increased absorption
  - Decreased excretion
  - Increased bone resorption secondary to hyperparathyroidism or immobility
  - Hemoconcentration
IX. Hypercalcemia (continued)

- Data collection
  - Early sign: tachycardia
  - Shortened ST interval
  - Impaired respiratory movement
  - Muscle weakness
  - Renal calculi formation
  - Hypoactive bowel sounds

- Interventions
  - Accurate monitoring of body systems related to impact of changes in serum calcium status
  - Careful positioning and mobility
  - Monitoring for signs of renal calculi
X. Hypomagnesemia

- **Description**
  - Serum magnesium level lower than 1.6 mg/dL

- **Causes**
  - Insufficient intake
  - Increased secretion
  - Intracellular movement

- **Data collection**
  - Peaked T wave, depressed ST segment
  - Shallow respirations
  - Positive Trousseau’s and Chvostek’s signs

- **Interventions**
  - Initiate seizure precautions
  - Monitor for reduced deep tendon reflexes
XI. Hypermagnesemia

- **Description**
  - Serum magnesium level exceeds 2.6 mg/dL

- **Causes**
  - Magnesium-containing antacids and laxatives

- **Data collection**
  - Prolonged PR interval
  - Diminished or absent deep tendon reflexes

- **Interventions**
  - Administer diuretics as prescribed to increase renal excretion of magnesium
  - Administer calcium chloride or calcium gluconate as prescribed
  - Recommend magnesium-restricted dietary intake
  - Educate client to avoid laxatives and antacids containing magnesium
XII. Hypophosphatemia

- **Description**
  - Serum phosphorus level lower than 2.7 mg/dL
  - Accompanied by increased serum calcium level

- **Causes**
  - Malnutrition and starvation
  - Malignancy

- **Data collection**
  - Shallow respirations
  - Weakness
  - Decreased deep tendon reflexes
  - Decreased bone density
  - Central nervous system changes
XII. Hypophosphatemia (continued)

- Interventions
  - Administer phosphorus orally with vitamin D supplement
  - Monitor renal system before administering phosphorus
  - Position and/or move client carefully
XIII. Hyperphosphatemia

- **Description**
  - Serum phosphorus level exceeding 4.5 mg/dL
  - Accompanied by decreased serum calcium level
  - Health problems that occur focused on hypocalcemia when serum phosphorus levels increase

- **Causes**
  - Decreased renal excretion secondary to renal insufficiency
XIII. Hyperphosphatemia (continued)

- Data collection
  - Refer to hypocalcemia

- Interventions
  - Administer phosphate-binding medications
  - Recommend dietary changes, decreasing intake of high-phosphorus foods
  - Educate client to take phosphate-binding medications with or immediately following meals
The nurse is assisting in the care of a group of clients on the nursing unit. The nurse determines that a client with which of the following diagnoses is the one who has the least amount of risk for developing third-spacing of body fluid?

1. Laënnec’s cirrhosis
2. Ischemic stroke
3. Major burn
4. Renal failure
Question 1

- **Answer:** 2

- **Rationale:** Fluid that shifts into the interstitial spaces and remains there is referred to as *third-space fluid*. This fluid is physiologically useless because it does not circulate to provide nutrients for the cells. Common sites of third-spacing include the pleural and peritoneal cavities and the pericardial sac. Risk factors include clients with liver or kidney disease, major trauma, burns, sepsis, major surgery, malignancy, gastrointestinal (GI) malabsorption, and malnutrition. The client who suffered a stroke is not at risk for third-spacing.