

1  **Fluid and Electrolyte Imbalances**  
**Acid Base Imbalances**

Unit III–

Lemone and Burke Chapter 10

2  **Objectives**

- Discuss factors affecting fluid and electrolyte balance
- Discuss specific lab data and their implications as they relate to fluid and electrolyte balances.
- Explain pathophysiology, manifestations, nursing diagnoses and interventions of imbalances of the following electrolytes:
  - a. Sodium
  - b. Potassium
- Develop and implement a plan of care for a client with fluid and electrolyte imbalance

3  **Homeostasis**

- Body's attempt to maintain state of physiologic balance in presence of constantly changing conditions
- Necessary for body to function optimally at a cellular level and as a total organism
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4  **Body Fluid Composition**

- Water – primary component
  - Medium for transport
  - Medium for metabolic reaction within cell
  - Helps regulates body temperature
  - Provides insulation
  - Provides form, structure, and shock absorption
  - Acts as a lubricant
  - Contribute to enzyme reactions
  - Essential for neuromuscular activity
- 

5  **Body Fluid Composition**

- Electrolytes
  - Charged particles called ions
  - Anions and cations
  - Assist in regulating water balance
  - Help regulate and maintain acid-base balance
  - Contribute to enzyme reaction
  - Essential for neuromuscular activity
- 

6  **Body Fluid Composition**

7  **Body Fluid Composition**

- Plasma and interstitial fluid similar in electrolyte composition but intracellular differs significantly

8  **Body Fluid Movement**

- Osmosis (Fig. 10-3)
  - Water moving through a semi-permeable membrane from lower to higher solute concentration
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  - (<- Water moves right to left)
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9  **Body Fluid Movement**

- Diffusion (Fig. 10-5)
  - Solute molecules moving from high concentration to low concentration to become evenly distributed

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- Arrows show movement of solutes

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10  **Body Fluid Movement**

- Filtration (Fig. 10-6)
  - Water and solutes move from high hydrostatic pressure to low hydrostatic pressure

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11  **Body Fluid Movement**

- Active Transport (Fig. 10-7)
  - Allows molecules to move across cell membranes and epithelial membranes against a concentration gradient

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12  **Body Fluid Regulation**

- Thirst
- Kidneys
- Renin-Angiotensin-Aldosterone System
- Antidiuretic Hormone (ADH)
- Atrial Natriuretic Peptide (ANP)

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13  **Fluid Volume Deficit (FVD)**

- Causes
  - Excessive fluid loss
  - Insufficient fluid intake
  - Failure of regulatory system
  - Third spacing

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14  **Manifestations - FVD**

- ▶ Dry mucous membranes
- ▶ Decreased urinary output
- ▶ Fatigue
- ▶ Altered mental status, anxiety, restlessness
- ▶ Dry skin, pale, cool extremities
- ▶ Tachycardia,
- ▶ Decreased blood pressure
- ▶ Increased body temperature
- ▶ Thirst
- ▶ Weight loss

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15  **Diagnosing - FVD**

- Serum electrolytes
- Serum osmolality
- Hemoglobin and hematocrit
- Urine specific gravity

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- 16  **Management - FVD**  
 Rehydration
- Water for mild fluid deficit
  - Sports drink for moderate FVD
  - IV fluid for severe fluid deficit involving electrolyte imbalance
- 17  **Health Promotion and Assessment**  
 Instruct on adequate fluid intake  
 Sports drinks for outside activities or exercise – esp in hot weather  
 Fluid intake should include 2500ml/day  
 Collect health history  
 Physical assessment
  - Older adults
- 18  **Nursing diagnosis - FVD**  
 Deficient Fluid Volume  
  
 Ineffective Tissue Perfusion  
  
 Risk for Injury
- 19  **Intervention**  
 Assess intake and output  
 Vital signs  
 Administer oral and/or IV fluids  
 Monitor lab values  
 Monitor LOC  
 Institute safety precautions  
 Provide adequate skin care  
 Instruct patient
- 20  **Fluid Volume Excess**  
 Both water and sodium are retained in the body  
 Fluid overload
- 21  **Manifestations and Complications**  
 Weight Gain ( >5% in a short period)  
 Full bounding pulse  
 Distended neck and peripheral veins  
 Dyspnea with cough
  - Moist crackles, pulmonary edema Polyuria  
 Ascites  
 Peripheral edema, if severe - anasarca
- 22  **Management – Fluid Volume Excess**  
 Medications
  - Loop diuretics
  - Thiazide-type diuretics

- Potassium sparing diuretics
  - Fluid Management
    - Restriction
  - Dietary Management
    - Decreased sodium intake
  -
- 23  **Health Promotion and Assessment**
  - Eval risk factors
  - Low sodium diet
  - Health history
  - Physical assessment
  -
- 24  **Interventions - Fluid Volume Excess**
  - ▶Low sodium diet
  - ▶Assess vital signs
  - ▶Elevate lower extremities
  - ▶Daily weight
  - ▶Intake and output
  - ▶Oral hygiene
  - ▶Diuretics
  - ▶Assess skin
  - ▶Reposition Q 2 hours
  - ▶Monitor O2 saturation
  -
- 25  **Nursing Diagnosis –**
  - Fluid Volume Excess
  - Impaired gas exchange
  - Risk for impaired skin integrity
  -
- 26  **Electrolytes**
  - Na – 135 – 145 mEq/L
  - K – 3.5 – 5.0 mEq/L
  - Ca – 8.5 – 10.0 mEq/dL
  - Phos – 2.5 – 4.5 mg/dL
  - Magnesium – 1.6- 2.6 mEq/dL
- 27  **Sodium Imbalance**
  - Most plentiful electrolyte in ECF
  - Normal range 135-145 mEq/L
  - Primary regulator of volume, osmolality and distribution of ECF.
  - Most of the body's sodium comes from diet
  - The kidney excretes/conserves sodium in response to changes in vascular volume
- 28  **Hyponatremia**
  - Lab Values

- Serum sodium <135 mEq/L (Critical <120 mEq/L)
- Serum osmolality <280 mOsm/kg
- Causes
  - Excess sodium loss (kidneys, GI tract, skin)
  - Water gains r/t renal disease, heart failure, liver failure
  - SIADH
  - Excessive hypotonic IV fluids (NS 0.45%)
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- 29  **Manifestation - Hyponatremia**
  - Anorexia
  - Nausea, Vomiting
  - Diarrhea, abdominal cramping
  - Headache
  - Altered mental status
  - Muscle cramps, weakness, tremors
  - Seizure and coma
  - Decreased serum sodium and osmolality
- 
- 30  **Management - Hyponatremia**
  - Fluid and dietary management
    - Isotonic saline (NaCl 0.9%) or Lactated Ringer sol.
      - 3% saline may be given cautiously for severe sodium loss.
    - Loop diuretics (Lasix)
    - Increase foods high in sodium (box 10-4)
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- 31  **Interventions - Hyponatremia**
  - I+O
  - Isotonic solutions
  - Fluid restriction
  - Daily weight
  - Monitor labs
  - Assess for neuro changes
  - Assess muscle strength and tone
- 32  **Nursing Diagnosis - Hyponatremia**
  - Risk for Fluid Volume Deficit
    -
  - Risk for Ineffective Cerebral Tissue Perfusion
    -
- 
- 33  **Hypernatremia**
  - Labs:
    - Serum sodium level > 145 mEq/L
    - Osmolality > 295 mOsm/kg
    - Sodium gain
    - Water loss
    - Excess sodium in ECF stimulates release of ADH -more water retained
    - The thirst mechanism stimulated to increase intake of water
    - Hypernatremia almost never occurs in people with intact thirst mechanism
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- 34  **Causes - Hypernatremia**
  - Altered thirst mechanism

- Profuse sweating
- Diarrhea
- Diabetes Insipidus
- Oral electrolyte solutions
- Excess IV fluids such as NS, 3% or 5% NaCl
- Inability to respond to thirst sensation or obtain water

35  **Manifestation - Hypernatremia**

- Thirst
- Increased temperature
- Dry, sticky mucous membranes
- Restlessness
- Weakness
- Altered mental status
  - Decreased level of consciousness
  - Muscle twitching
- Seizures
- 

36  **Management - Hypernatremia**

- Oral or Intravenous fluid intake
- Hypotonic solution 0.45% NaCl
- 5% dextrose in water (provides pure water when the glucose is metabolized)
- Diuretics to increase sodium excretion
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37  **Nursing Diagnosis - Hypernatremia**

- Risk for injury
  - mental status and brain function is
  - affected by elevated Na, - brain swells
- Intervention:
  - Assess neuro function
  - LOC, N+V
  - Monitor labs
  - Na and osmolality

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38  **Potassium Imbalance**

- ▶ Normal Value 3.5 – 5.0 mEq/L
- ▶ Hypokalemia
  - <3.5 mEq/L      Critical value: <2.5 mEq/L
- ▶ Hyperkalemia
  - > 5.0mEq/L      Critical value: >6.5 mEq/L
- ▶ Kidneys are principle organ for eliminating potassium
- ▶ Most potassium intake is acquired through diet

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39  **.Hypokalemia**

- Potassium < 3.5 mEq/L
- Causes
  - Excess GI losses: vomiting, diarrhea, ileostomy drainage
  - Renal losses: diuretics, hyperaldosteronism
  - Inadequate intake
  - Alkalosis,

- Insulin Therapy
- 
- 40  **Manifestation - Hypokalemia**
  - Cardiovascular
    - Dysrhythmias
    - ECG changes
  - Gastrointestinal
    - Nausea, vomiting
    - Anorexia
    - Decreased bowel sounds
  - Neuromuscular
    - Muscle weakness
    - Leg cramps
- 
- 41  **Management - Hypokalemia**
  - Potassium supplements (see box pg 221)
    - Potassium chloride- treatment of choice
    - KCL 40 mEq daily
    - Orally dilute with juice and food
    - Intravenously, administer slowly and diluted in IV solution to prevent burning
  - Dietary Intake
    - High in potassium rich foods
- 
- 42  **Health Promotion and Assessment**
  - Discuss use of sports drinks to replace fluid loss – esp athletes
  - Diet teaching
  - Medication teaching
  - Health history
  - Physical assessment
- 43  **Interventions - Hypokalemia**
  - Monitor K+
  - VS
  - Assess Pulses
  - Assess muscle tone
  - Monitor respirations
  - I+O
  - Bowel sounds
- 
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- 44  **Nursing Diagnosis - Hypokalemia**
  - Decreased Cardiac Output
    -
  - Activity Intolerance
  - 
  - Risk for Imbalanced Fluid Volume
    -
  - Risk for injury
  - Risk for ineffective health maintenance
- 
- 45  **Hyperkalemia**

○ High serum potassium >5.0 mEq/L

○ Causes:

- Renal failure
- Potassium sparing diuretics
- Adrenal insufficiency
- Excess potassium intake
- Aged blood
- Acidosis

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46  **Manifestations - Hyperkalemia**

- ▶ Cardiovascular
  - Tall, peaked T waves, widened QRS
  - Dysrhythmias
  - Cardiac Arrest
- ▶ Gastrointestinal
  - Nausea and vomiting
  - Abdominal cramping and diarrhea
- ▶ Neuromuscular
  - Muscle twitching and tremors
  - Paresthesia
  - Flaccid paralysis

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47  **Management - Hyperkalemia**

○ Medications

- Calcium gluconate
- Insulin R and glucose 50% IV
- Kayexalate
- Diuretics if renal function is normal

○ Dialysis

- If renal function is severely limited

○ Dietary

- Decrease potassium rich foods

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48  **Health Promotion Hyperkalemia**

○ Teaching – K supplement use

○ Diet – what foods to avoid

Assessment:

Health history –

Physical assessment

49  **Intervention**

- Monitor ECG pattern
- Monitor lab values
- Accurate I&O
- Monitor for edema
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50  **Nursing Diagnosis - Hyperkalemia**



Risk for Decreased Cardiac Output

Risk for Activity Intolerance

● Same as Hypokalemia

Risk for Imbalanced Fluid Volume

Ineffective health maintenance

51  **Case Study**

63 y/o female with hx of DM and ESRD

Comes to ER c/o SOB and extreme weakness

52  **Case Study**

43 y/o male w Hx DM comes to ER w c/o flu for 3 days, not feeling good

53  **Acid-Base Disorders**

Homeostasis keeps hydrogen ion in body fluids in narrow range

Hydrogen ions determine acidity of body fluids

Relationship between hydrogen ion and pH is inverse

54  **Buffer Systems**

Substances to prevent major changes in pH:

● Bicarbonate/carbonic acid buffer

● Phosphate buffer

● Protein buffer

55  **Respiratory System**

Regulates carbonic acid by retaining or eliminating CO<sub>2</sub>

Works within minutes

Alkalosis depresses respiratory center

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56  **Renal System**

Long term regulation of acid base balance

Slow acting (hours to days)

Alkalosis – kidneys retain hydrogen ions and excrete bicarb

Acidosis – kidneys retain bicarb and excrete hydrogen ions

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57  **ABG – normal values**

pH – 7.35-7.45

PaCO<sub>2</sub> – 35-45 mm Hg

PO<sub>2</sub> – 80-100 mm Hg

HCO<sub>3</sub> – 22-26 mEq/L

BE -3.0 to +3.0

Table 10-10, pg 240

58  **Respiratory Acidosis**

pH < 7.35

PaCO<sub>2</sub> is high

- Renal system attempts compensation - slow  
 59  **Respiratory Alkalosis**  
 pH > 7.45  
  
 PaCO<sub>2</sub> is low  
  
 Renal system attempts compensation - slow
- 60  **Metabolic Acidosis**  
 pH < 7.35  
  
 HCO<sub>3</sub> low  
  
 Resp system attempts compensation
- 61  **Metabolic Alkalosis**  
 pH > 7.45  
  
 High HCO<sub>3</sub>  
  
 Resp system attempts compensation
- 62  **Nursing diagnosis**  
 Risk for impaired gas exchange  
 Decreased CO  
 Risk for excess/deficient fluid volume  
 Risk for injury  
 Ineffective airway clearance  
 Ineffective breathing patterns
- 63  **Sample ABG**  
 pH – 7.30  
 PCO<sub>2</sub> – 51 mm Hg  
 PO<sub>2</sub> – 84 mm Hg  
 HCO<sub>3</sub> – 25 mEq/L  
 BE - -2
- 64  **Sample ABG**  
 pH – 7.51  
 PCO<sub>2</sub> - 38  
 PO<sub>2</sub> - 88  
 HCO<sub>3</sub> – 32 mEq/L  
 BE - +3
- 65  **Sample ABG**  
 pH – 7.50  
 PCO<sub>2</sub> – 18 mm Hg  
 PO<sub>2</sub> – 84 mm Hg  
 HCO<sub>3</sub> – 25 mEq/L  
 BE - -2
- 66

OpH – 7.30  
OPCO2 – 36 mm Hg  
OPO2 – 84 mm Hg  
OHCO3 – 15 mEq/L  
OBE - -2  
O

67 