Adult CCRN/CCRN-E/CCRN-K Certification Review Course: Endocrine

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Disclosures
- Nothing to disclose
Endocrine disorders and emergencies

Introduction
- Disorders of the endocrine system are related to either an excess or a deficiency of a specific hormone or a defect at the hormone's receptor site.

Body Harmony (cont)

Endocrine
- Acute hypoglycemia
- Diabetic ketoacidosis
- Diabetes insipidus (DI)
- Hyperglycemic hyperosmolar nonketotic coma (HHNK)

20% Endo
20% Heme
80% GI

Endocrine
Body Harmony

- Every cell in the body is under endocrine influence

Acute Complications of Diabetes

- Acute hypoglycemia
- Diabetic ketoacidosis (DKA)
- HHNK

Acute Hypoglycemia

- Serum glucose (SG) <50 mg/dL
- Causes
  - Too much insulin
  - Too few calories
Acute Hypoglycemia (cont)

- Signs and symptoms
  - Tachycardia
  - Δ level of consciousness: irritable, confused, unconscious
  - Skin: pale, cool, clammy
  - Seizures
  - Blurred vision

- Treatment
  - Give glucose
    - Enteral
    - Parenteral (if SG <20 mg/dL)
  - Determine cause

Review Questions
Question 1

A patient received morning insulin NPH before an NPO order was written for a procedure. Early afternoon, in addition to getting a blood glucose level, the nurse should look for clinical signs such as:

A. Thirst, confusion, and hypotension
B. Anxiety, dehydration, and warm/flushed skin
C. Irritability, tachycardia, and pale/cool skin
D. Hunger, bradycardia, and increased urinary output

Question 1—Rationale

A patient received morning insulin NPH before an NPO order was written for a procedure. Early afternoon, in addition to getting a blood glucose level, the nurse should look for clinical signs such as:

C. Irritability, tachycardia, and pale/cool skin—The patient had insulin not followed by eating
   • Thirst, confusion, and hypotension—S & S of hyperglycemia
   • Anxiety, dehydration, and warm/flushed skin—Not assessment findings indicative of hypoglycemia
   • Hunger, bradycardia, and increased urinary output—Hunger and increased urine output are signs and symptoms of hyperglycemia

Diabetic Ketoacidosis

- Occurs in 2%–5% of type 1 diabetes mellitus (DM) per year
- Most often precipitated by illness (infection)
- 1%–10% of DKA victims will die
- Mortality is highest in patients >60-years-old
Diabetic Ketoacidosis (cont)
- The metabolic derangements result from absolute or relative insulin deficiency
  - Blood glucose >500
  - pH <7.32
  - HCO₃ <15mEq/L
  - Increased anion gap
  - Positive ketones in urine
  - Azotemia

Diabetic Ketoacidosis: Signs and Symptoms
- Hypotension
- Tachycardia
- Tachypnea
- Kussmaul respirations
- Decreased skin turgor
- Dry mucous membranes
- ? abdominal pain, nausea, and vomiting

Diabetic Ketoacidosis: Fluid Therapy
- Restore circulating volume
- 1–2 L of isotonic saline in 2 hours
- D5/.45% NS after blood sugar decreases to 250
- May receive 8–10 L during the first 24 hours
Diabetic Ketoacidosis: Drug Therapy
- Regular insulin—continuous IV or bolus
- Lower 100 mg/dL/hour
- Monitor potassium levels carefully
- Bicarbonate for severe acidosis

Hyperosmolar Hyperglycemic Nonketotic Coma
- A hyperosmolar state from severe hyperglycemia without ketosis seen predominantly in older adults and patients with type II DM
  - Glucose >800 mg/dL
  - Osmolality >350 mOsm
  - Ketones negative
  - pH >7.3
  - Severe dehydration

Hyperosmolar Hyperglycemic Nonketotic Coma
- Fluid therapy
  - 2 L of normal saline in 1 hour
  - Followed by fluid replacement
- Drug therapy
  - IV insulin 10 units per hour
  - Monitor potassium and give PRN
Review Questions

A patient is admitted with suspected DKA. The nurse would expect the following lab abnormalities:

A. Hypoglycemia, acidosis, hyperkalemia, positive ketones
B. Hyperglycemia, alkalosis, hypokalemia, negative ketones
C. Hypoglycemia, alkalosis, hypokalemia, negative ketones
D. Hyperglycemia, acidosis, hyperkalemia, positive ketones

Question 2—Rationale

A patient is admitted with suspected DKA. The nurse would expect the following lab abnormalities:

D. Hyperglycemia, acidosis, hyperkalemia, positive ketones
   - Hyperglycemia → not enough insulin to pull glucose into cell
   - Acidosis → ketone production lowers pH
   - Hyperkalemia → acidosis cause K to leave cell
   - Positive ketones → a byproduct of cells going to alternative sources for fuel
**Question 3**

A patient was admitted with DKA 3 hours ago. Admitting laboratory data: glucose 475, pH 7.27, K 4.9. After insulin bolus and infusion and 2 L of normal saline, labs revealed: glucose 227, pH 7.32, K 4.2. The most appropriate action would be:

A. Switch the normal saline infusion to D5/.45% NS  
B. Increase the insulin infusion by 2 units per hour  
C. Administer 1 ampule of sodium bicarbonate  
D. Administer 10 mEq of potassium by IV piggyback

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**Question 3—Rationale**

A patient was admitted with DKA 3 hours ago. Admitting laboratory data: glucose 475, pH 7.27, K 4.9. After insulin bolus and infusion, and 2 L of normal saline, labs revealed: glucose 227, pH 7.32, K 4.2. The most appropriate action would be:

A. Switch the normal saline infusion to D5/.45% NS—Once the glucose falls below 250, the water will start to follow the glucose into the cell, potentially causing cerebral edema. Changing the fluid to D5/45 helps to mitigate this
  - Increase the insulin infusion by 2 units per hour—The glucose should not be lowered more than 100 mg/dL/hr
  - Administer 1 ampule of sodium bicarbonate—The pH is rising; no need for bicara
  - Administer 10 mEq of potassium by IV piggyback—The drop in K is excepted as the pH goes up

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**Diabetes Insipidus Syndrome of Inappropriate Antidiuretic Hormone**

- Acute complications of water regulation
Diabetes Insipidus
- A problem of impaired water conservation by the kidneys
  - Polyuria
  - Low urine-specific gravity
  - Hypernatremia
  - Fluid-deficit dehydration

Neurogenic or Central Diabetes Insipidus
- Lack of antidiuretic hormone (ADH) from the hypothalamus or posterior pituitary gland
- Normal regulatory mechanisms are not functioning typically because of neurogenic dysfunction
- Hypovolemia and dehydration occur with a high sodium level (ie, >145 mEq/L)

Neurogenic Diabetes Insipidus: Causes
- Idiopathic—autoimmune
- Head trauma
- Hypoxic or ischemic encephalopathy
- Neurosurgery
Nephrogenic Diabetes Insipidus: Causes

- Osmotic agents or states
- Renal failure
- Decreased osmotic pressure
- Pregnancy

There is ADH, but the kidneys do not respond to it

Diabetes Insipidus: Signs and Symptoms

- Polyuria
- Polydipsia
- Dehydration/hypovolemia

Diabetes Insipidus: Laboratory Data

- Plasma osmolality
  - High >295 mOsm/kg
- Serum sodium
  - Normal or >145 mEq/L
- Urine osmolality
  - Low <250 mOsm/kg
- Urine-specific gravity
  - Low <1.005 (1.005–1.030)
Endocrine

Diabetes Insipidus: Treatment
- Correct the underlying cause
- Replace free water
- Neurogenic: replace ADH
- Nephrogenic: thiazide diuretics
- Nutrition
- Elimination problems

Syndrome of Inappropriate Antidiuretic Hormone
- Too much release of ADH stimulates the kidneys to retain water, resulting in water intoxication
  - Overhydration
  - Low serum osmolality
  - Hyponatremia

Syndrome of Inappropriate Antidiuretic Hormone: Causes
- Malignancies: lung, pancreas, duodenum, lymphatic, prostate, thymus
- Meningitis
- Brain abscess or tumors
- Head injury (blunt trauma or hemorrhage)
- Mechanical ventilation
- Drugs
Syndrome of Inappropriate Antidiuretic Hormone: Signs and Symptoms

- Weight gain
- Edema
- Signs of overhydration

Syndrome of Inappropriate Antidiuretic Hormone: Laboratory Data

- Plasma osmolality
  - Low <280 mOsm/kg
- Serum sodium
  - Low <135 mEq/L
- Urine osmolality
  - Normal or high >100 mOsm/kg
- Urine-specific gravity
  - High >1.030

Syndrome of Inappropriate Antidiuretic Hormone: Treatment

- Correct the underlying cause
- Fluid restriction
- Give sodium—normal or hypertonic saline
- Diuretic treatment
Question 4
A patient would be at increased risk for thrombosis and high risk for pulmonary emboli with which of the following?

A. DKA or SIADH
B. HHNK, DKA, or DI
C. SIADH, DI, or hypoglycemia
D. Neurogenic DI, SIADH, or HHNK

Question 4—Rationale
A patient would be at increased risk for thrombosis and high risk for pulmonary emboli with which of the following?

B. HHNK, DKA, or DI—All three of these disorders cause dehydration → thicker blood → increase risk of thrombosis
   - DKA or SIADH—SIADH causes fluid retention, so no increased risk of thrombosis
   - SIADH, DI, or hypoglycemia—SIADH causes fluid retention, so no increased risk of thrombosis
   - Neurogenic DI, SIADH, or HHNK—SIADH causes fluid retention, so no increased risk of thrombosis
Question 5

A patient with a traumatic brain injury experiences a change in urinary output over the last 24 hours. If a diagnosis of DI is suspected, which of the following findings would be most likely?

A. Decreased serum and urine osmolarity
B. High serum and low urine osmolarity
C. Low serum and high urine osmolarity
D. Increased serum and urine osmolarity

Question 5—Rationale

A patient with a traumatic brain injury experiences a change in urinary output over the last 24 hours. If a diagnosis of DI is suspected, which of the following findings would be most likely?

B. High serum and low urine osmolarity—In DI, water is lost but not equal amounts of Na → disproportionate amounts of water in urine and Na in blood
   - Decreased serum and urine osmolarity—Increased serum
   - Low serum and high urine osmolarity—The opposite would occur because of water loss
   - Increased serum and urine osmolarity—Low urine because of increased volume of water

Summary

Disorders of the endocrine system are related to either an excess or a deficiency of a specific hormone or a defect at the hormone's receptor site.