Chapter 24

Endocrine Emergencies and Nutritional Disorders

Learning Objectives

- Describe the incidence, morbidity, mortality rates of endocrine emergencies, including need for rapid assessment, intervention
- Discuss the anatomy, physiology of organs, structures involved in endocrinological diseases
- Describe normal glucose metabolism

Learning Objectives (Cont'd)

- Describe the pathophysiology of type 1 and type 2 diabetes
- Discuss the pathophysiology of diabetic metabolism
- Describe the assessment findings of the hypoglycemic patient
Learning Objectives (Cont’d)

- Develop a treatment plan based on assessment findings of the hypoglycemic patient
- Describe assessment findings of the hyperglycemic patient
- Develop a treatment plan based on assessment findings of the hyperglycemic patient
- Describe assessment findings of a patient with diabetic ketoacidosis
- Develop a treatment plan for diabetic ketoacidosis
- Describe the assessment findings of hyperosmolar hyperglycemic nonketotic coma
- Develop a treatment plan for hyperosmolar hyperglycemic nonketotic coma
- Discuss the pathophysiology of pituitary gland disorders
- Describe assessment findings of patients with pituitary gland disorders
Learning Objectives (Cont'd)

• Develop a treatment plan for pituitary gland disorder
• Discuss the pathophysiology of thyroid gland disorders
• Describe assessment findings of patients with thyroid gland disorders

Learning Objectives (Cont'd)

• Develop a treatment plan for thyroid gland disorder
• Discuss the pathophysiology of parathyroid gland disorders
• Describe assessment findings of patients with parathyroid gland disorders

Learning Objectives (Cont'd)

• Develop a treatment plan for parathyroid gland disorder
• Discuss the pathophysiology of adrenal gland disorders
• Describe assessment findings of patients with adrenal gland disorders
Learning Objectives (Cont’d)

- Develop the treatment plan for adrenal gland disorder
- Discuss the etiology of nutritional disorders
- Discuss the pathophysiology of nutritional disorders

Learning Objectives (Cont’d)

- Describe the assessment findings of patients with nutritional disorders
- Develop a treatment plan for nutritional disorders

Introduction

- Endocrine system has eight glands
  - Hormones send chemical messages, maintain homeostasis
Introduction (Cont’d)

- Endocrine communication
  - Hormone release
  - Direct
    - Cells with same function interact
  - Paracrine
    - With other cells within same tissue, no direct contact
    - Paracrine factors/cytokines
  - Synaptic
    - Neurotransmitters
    - Transmit over long distances rapidly

Anatomy & Physiology

Endocrine Glands

Overview of the endocrine system

- Hypothalamus
  - Command center
  - Cerebrum of brain
  - Nerve cells
Anatomy and Physiology (Cont’d)

- Overview of the endocrine system
  - Hypothalamus
    - Glandular cells
      - Produce, release hormones that trigger target tissue in anterior, posterior lobes of pituitary gland
      - Regulate hormones
      - Regulatory hormones direct pituitary gland to increase/decrease hormone production, coordinate body systems

Anatomy and Physiology (Cont’d)

- Overview of endocrine system
  - Pituitary gland
    - Thermostat for hormone-producing glands
    - Anterior lobe
      - Endocrine cells, produce hormones
      - Regulated by hormones produced by hypothalamus, deposited into bloodstream
    - Posterior lobe
      - Contains distal ends of some hypothalamic neurons
      - Produce hormones, not released into bloodstream
      - Stored in secretory vesicles
      - ADH, lack of may cause diabetes insipidus
      - Oxytocin, fetal delivery
Anatomy and Physiology (Cont’d)

Overview of endocrine system
- Thyroid gland
  - Affects almost every organ
  - Critical for normal metabolism
  - Thyroid follicles contain suspended proteins
  - TSH cause thyroid gland to release T4, T3, increases cellular metabolism
  - Produces calcitonin

Overview of the endocrine system
- Parathyroid glands
  - Four embedded in thyroid
  - Increase fluid calcium levels
  - Causes calcium release into blood by bones, kidneys to reabsorb calcium

Overview of endocrine system
- Thymus
  - In mediastinum, behind sternum
  - Releases several hormones, thymosin
Overview of endocrine system

- Pancreas
  - Pancreatic acini connect to ducts that deposit alkaline enzyme-rich fluid directly into the digestive tract
  - Islets of Langerhans
    - Insulin decreases blood glucose levels, prompts liver to convert circulating glucose into glycogen
    - Glycogenolysis
    - Gluconeogenesis

- Adrenal glands
  - Adrenal cortex
    - Surrounds inner adrenal medulla
  - Adrenal medulla
    - Neural, endocrine cells
    - Releases adrenocortical/corticosteroids steroids
Anatomy and Physiology (Cont’d)

- Overview of endocrine system
  - Gonads
    - Promote sexual maturation to puberty, reproductive needs
    - Males, produce androgens, testosterone
    - Females, ovaries

Endocrine Disorders

- Disorders of the pituitary gland
  - Diabetes insipidus
    - Passing of water
    - Sodium in blood
    - Posterior pituitary deficiencies
    - Central DI caused by lack of ADH production

Endocrine Disorders (Cont’d)

- Disorders of the pituitary gland
  - Diabetes insipidus
    - History and physical findings
      - Polydipsia
      - Polyuria
      - Muscle spasms
      - Hyporeflexia
      - Coma
      - Altered mentation
Endocrine Disorders (Cont’d)

- Disorders of the pituitary gland
  - Diabetes insipidus
    - Therapeutic interventions
      - IV with isotonic saline
      - Desmopressin
      - Hormone replacement
      - Serum sodium, urine volume closely monitored

Endocrine Disorders (Cont’d)

- Disorders of the pituitary gland
  - General hypopituitarism
    - Deficiency of pituitary hormones
    - Abnormal regulation of TSH
    - Hypothyroidism
    - GH deficiency/excessiveness
    - LH, FSH deficiency
    - Pituitary adrenal insufficiency
    - Signal to adrenals absent

Endocrine Disorders (Cont’d)

- Disorders of the thyroid gland
  - Hyperthyroidism
    - Overactive thyroid
    - History and physical findings
      - Tachycardia
      - Rapid respirations
      - Heat intolerance
      - Diarrhea
      - Weight loss despite polyphagia
      - Sweating
      - Irritability
      - Graves’ Disease
      - Thyrotoxicosis
      - Thyroid storm
      - Medical emergency
      - Extreme hypermetabolic state
      - Ventilation
      - Tachycardia
      - Sinus tachycardia
      - Atrial fibrillation
Endocrine Disorders (Cont’d)

- Disorders of thyroid gland
  - Hyperthyroidism
    - Therapeutic interventions
      - Airway support
      - Shock management
      - Dysrhythmia management
      - Beta-blockers
      - Calcium channel blockers
      - Steroids

- Disorders of the thyroid gland
  - Hypothyroidism
    - Underactive thyroid
    - Elevated TSH level, pituitary enlargement
    - Iodine deficiency
    - Congenital, abnormal thyroid formation

- Disorders of the thyroid gland
  - History and physical findings
    - Thyroid hormone critical for brain growth
    - Autoimmune process, body makes antibodies attacking thyroid
    - Myxedema
Endocrine Disorders (Cont’d)

- Disorders of the thyroid gland
  - Hyperthyroidism
    - Therapeutic interventions
      - Supportive
      - Airway management
      - Temperature regulation
      - Shock prevention

Endocrine Disorders (Cont’d)

- Disorders of the parathyroid gland
  - Hyperparathyroidism
    - Oversecretion of PTH
    - Parathyroid gland tumor
    - History and physical findings
      - Excess calcium
      - Muscle weakness
      - Fatigue
      - Nausea, vomiting
      - Volume depletion

Endocrine Disorders (Cont’d)

- Disorders of the thyroid gland
  - Hypothyroidism
    - History and physical findings
      - Excess calcium
      - Muscle weakness
      - Fatigue
      - Nausea, vomiting
      - Volume depletion
    - Therapeutic interventions
      - Supportive
Endocrine Disorders (Cont’d)

- Disorders of the parathyroid gland
  - Hypoparathyroidism
    - Autoimmune disease
    - Thyroidectomy
  - History and physical findings
    - Altered mental status
    - Parasthesia of extremities
    - Muscle cramping
    - Spasms
    - Twitching
    - Tremors
    - Seizures

- Disorders of the pancreas
  - Hypoglycemia
    - Low blood sugar
    - Common in type 1 and 2 diabetes
    - Hypoglycemic unawareness
Endocrine Disorders (Cont’d)

- Disorders of the pancreas
  - Hypoglycemia
    - History and physical findings:
      - Sugar below 50 mg/dL
      - Hunger, agitation, altered mentation, nausea, weakness, confusion, tachycardia, cool/clammy skin, seizures
      - Increase blood glucose level

Endocrine Disorders (Cont’d)

- Disorders of the pancreas
  - Hypoglycemia
    - Therapeutic interventions:
      - Increase blood glucose level

Endocrine Disorders (Cont’d)

- Disorders of the pancreas
  - Hyperglycemia
    - Diabetic ketoacidosis
      - Persistent, caused by lack of insulin
      - Dehydration, electrolyte abnormalities, metabolic acidosis
      - Body cannot manage glucose
      - Ketones cause acidosis
Endocrine Disorders (Cont’d)

- Disorders of the pancreas
  - Hyperglycemia
    - Diabetic ketoacidosis
      - Glucose in urine, hyperosmotic, dehydration
      - Respiratory rate, tidal volume elevated
      - Give fluids, insulin
      - Monitor vital signs

- Disorders of the pancreas
  - Hyperglycemia
    - Hyperosmolar hyperglycemic nonketotic coma
      - Elevated glucose from poor or little insulin action
      - Blood glucose level increase
      - Severe volume depletion, CNS
      - Fluid therapy, insulin

- Disorders of the pancreas
  - Hyperglycemia
    - Hyperosmolar hyperglycemic nonketotic coma
      - history and physical findings
        - Severe volume depletion, CNS
        - Warm, dry skin
        - Dry mucous membranes
        - Poor skin turgor
        - Tachycardia
        - Weakness
Endocrine Disorders (Cont’d)

- Disorders of the pancreas
  - Hyperglycemia
    - Hyperosmolar hyperglycemic nonketotic coma
    - History and physical findings
      - Polyuria
      - Polydipsia
      - Polyphagia
      - Orthostatic hypotension
      - Supine hypotension
      - Altered mental status
      - Lethargy
      - Coma

- Gestational diabetes
  - Impaired glucose tolerance, elevated
  - Untreated, fetal death risk
  - Dietary modification, insulin therapy, glyburide

- History and physical findings
  - 25+ years
  - Obese
  - Impaired insulin secretion
  - Prior delivery of 9+ lb baby
  - First-degree relative with diabetes
  - Recurrent infections
  - African-Hispanic ancestry
Endocrine Disorders (Cont’d)

- Disorders of the pancreas
  - Gestational diabetes
    - Therapeutic interventions
    - Dietary modification
    - Insulin therapy
    - Glyburide

- Complications of diabetes
  - Microvascular complications
    - Retinopathy
    - Renal dysfunction, hypertension
    - Neuropathy
    - Autonomic neuropathy
  - Macrovacular complications
    - Peripheral vascular disease
    - Cerebrovascular disease
    - Coronary artery disease

Endocrine Disorders

- Disorders of the pancreas
  - Complications of diabetes
    - Microvascular complications
    - Retinopathy
    - Renal dysfunction, hypertension
    - Neuropathy
    - Autonomic neuropathy
    - Macrovacular complications
      - Peripheral vascular disease
      - Cerebrovascular disease
      - Coronary artery disease

Endocrine Disorders (Cont’d)

- Disorders of the adrenal glands
  - Adrenal insufficiency
    - Rapid deterioration of cardiovascular, metabolic status
    - Addison’s disease
    - Secondary adrenal insufficiency
Endocrine Disorders (Cont'd)

- Disorders of the adrenal glands
  - Adrenal insufficiency
    - History and physical findings
      - Weakness
      - Fatigue
      - Skin pigmentation darkening
      - Anorexia
      - Hypoglycemia
      - Weight loss
      - Early morning nausea, vomiting
      - Abdominal pain
    - Salt craving
    - Diarrhea
    - Fainting
    - Dizziness
    - Hypotension
    - Tachycardia
    - Dehydration signs
  - Therapeutic intervention
    - ABCs
    - IV access
    - Correction of electrolyte abnormalities

- Disorders of the adrenal glands
  - Cushing syndrome
    - Corticosteroids overproduction
    - Moon face
    - Fat accumulation above clavicles/upper back
    - Symptom management
Nutritional Disorders (Cont’d)

- Malnutrition
  - Body receiving inadequate energy to meet its metabolic needs
  - Dizziness, fainting, weight loss, neurological changes
  - Treat symptoms

Nutritional Disorders (Cont’d)

- Inadequate caloric intake
  - Marasmus
    - Overall lack of calories
  - Kwashiorkor
    - Inadequate protein calories compared with total calorie intake, maintains weight
  - Alcoholic ketoacidosis (AKA)
    - Body resorts to alternative energy sources

Nutritional Disorders (Cont’d)

- Inadequate vitamin intake
  - Fat-soluble vitamins
    - Stored in liver, not required daily
    - Vitamin A
    - Vitamin D
    - Vitamin E
    - Vitamin K
Nutritional Disorders (Cont’d)

• Inadequate vitamin intake
  ➢ Water-soluble vitamins
    • Not stored in body, replaced daily
    • Vitamin B₁ (thiamine)
    • Vitamin B₂ (riboflavin)
    • Vitamin B₃ (niacin)
    • Vitamin B₆ (pyridoxine)
    • Vitamin B₁₂ (cyanocobalamin)

Nutritional Disorders (Cont’d)

• Inadequate mineral intake
  ➢ Body function
  ➢ Anemia
  ➢ O₂-carrying ability of red blood cells

Chapter Summary

• Endocrine system, neurological system, responsible for helping body maintain homeostasis
  ➢ Neurological system responds more rapidly to changes, endocrine system longer, changes may remain in effect longer
  ➢ Endocrine system communicates through release of hormones by eight main endocrine glands: hypothalamus, pituitary, thyroid, parathyroid, thymus, pancreas, adrenal, and gonads
Chapter Summary (Cont’d)

- Hormones interact with target tissues in all parts of body to balance body systems, maintain homeostasis.

Chapter Summary (Cont’d)

- Most prominent endocrine disorders related to diabetes mellitus:
  - Type 1 diabetes, beta cells, found in islets of Langerhans located in pancreas, have ceased producing insulin, aiding movement of glucose across cell wall, into cell for metabolizing; also prompts liver to convert circulating glucose into glycogen for later use.

Chapter Summary (Cont’d)

- Diabetes mellitus:
  - Type 2 diabetes:
    - Insulin production diminished, no longer meets metabolic demands
    - Cellular receptor sites decreased sensitivity, no longer respond effectively to current insulin levels
  - Glucagon released by alpha cells in pancreas, acts on the liver to convert glycogen back to glucose, glycogenolysis.
Although rare, some endocrine disorders in addition to diabetes may prove rapidly fatal:

- Thyrotoxicosis/thyroid storm caused by overactivity of the thyroid gland
  - Tachypnea, tachycardia, shock, hyperthermia, delirium
  - Dysrhythmia management, shock management, airway support, beta blockers, steroids

- Myxedema, underactivity of the thyroid gland
  - Unexplained hypothermia, unexplained hypoglycemia, hypotension, respiratory depression, and coma
  - Supportive care, airway management, temperature regulation, treatment for shock

Most metabolic, nutritional disorders are not life threatening, build over a period, are diagnosed by the patient’s family physician:

- History on patient assessment
- Pathophysiology, interaction with other disease processes, modifications needed to current protocols to accommodate interactions