Chapter 30 Endocrinology

Terminology

- **Hormone**: chemical substance released by a gland that controls or affects processes in other glands or body systems.
- **Ductless gland**: gland that secretes chemical substances directly into the blood (aka: ductless glands).
- **Ducted gland**: gland that secretes chemical substances into nearby tissues through a duct (aka: ducted glands).

Physiology of the Endocrine System

- **Endocrine glands**
  - Have systemic effects.
  - Act on specific target tissue in specific ways.
  - May have single or multiple targets.
- **Disorders**
  - Disorders result from over- or underproduction of hormones.

Major Endocrine Glands

**Hypothalamus**
- Located deep within the brain.
- Some cells relay messages from the autonomic nervous system to the central nervous system.
- Other cells respond as gland cells to release hormones.
- Targets other glands, especially the pituitary glands.

**Posterior Pituitary**
- Releases oxytocin during pregnancy.
- Releases antidiuretic hormone (ADH).

**Anterior Pituitary**
- Releases growth hormone.
- Releases follicle stimulating hormone which stimulates development of sex cells (ovum or sperm).
- Releases luteinizing hormone that stimulates the release of estrogen, progesterone, or testosterone.
- Releases prolactin, which stimulates production of milk.

**Thyroid Gland**
- Releases hormones that stimulate cellular metabolism.
- Releases calcitonin which facilitates calcium uptake by bones and decreases calcium levels.
9 Parathyroid Glands
- Small, pea-shaped glands, located in the ____________________________ near the thyroid
- Typically four individual glands
- Regulate the level of ____________________________ in the body

10 Thymus Gland
- Stimulate reproduction and functional development of T ____________________________ of the white blood cells

11 Pancreas (1 of 2)
- ____________________________ organ
- Exocrine tissues called ____________________________ secrete digestive enzymes into the small intestine
- Endocrine tissues secrete hormones
  - Glycogenolysis
  - Gluconeogenesis

12 Pancreas (2 of 2)
- The pancreas produces the following types of cells:
  - ____________________________ (α)
  - Beta (β)
  - ____________________________ (δ)

13 Alpha Cells (α)
- Stimulate the release of ____________________________ and glycogen stores
- Promote ____________________________
  - generation of glucose from non-carbohydrate carbon substrates
- Allows for ____________________________
  - the conversion of glycogen polymers to glucose

14 Beta Cells (β)
- Stimulate the release of ____________________________

15 Delta Cells (δ)
- Produce ____________________________
  - Inhibit glucagon
  - Inhibit ____________________________

16 Adrenal Glands (1 of 2)
- Adrenal ____________________________
  - Inner segment of adrenal gland
  - Closely tied to autonomic nervous system
- Adrenal ____________________________
  - Outer layers of endocrine tissue, which secrete steroidal hormones
Adrenal Glands

- Releases epinephrine and norepinephrine
- Stimulate ______________________-like effects
- Aids in fluid/_______________________ regulation
- Aids in release of progesterone and testosterone

Pineal Gland

- Located in the roof of the thalamus.
- Related to the body’s “_________________________ clock”
- Implicated in __________________________ affective disorder

Other Organs with Endocrine Activity

- Digestive tract
- Heart

Disorders of the Pancreas

Diabetes Mellitus

- Marked by inadequate __________________________ in the body
- Glucose is required by ALL cells
- Glucose is the __________________________ substance that brain cells can metabolize
- Insulin allows glucose to enter cells
- Insulin allows body to store energy as __________________________ , protein, and fat

Glucose Metabolism

- __________________________: the constructive or “build up” phase of metabolism
- __________________________: the destructive or “breaking down” phase of metabolism
- The 2 main hormones that regulates glucose is insulin and glucagon
- __________________________ is the dominant hormone when blood glucose is low

Insulin and Glucagon

- Insulin is the dominant hormone when blood glucose level is __________________________
- Glucagon is the dominant hormone when blood glucose level is __________________________

Insulin and Glucagon

Insulin

- Major effects on target tissues
  - All cells increase uptake glucose
  - __________________________: increased production of glycogen,
protein, fat
- Increased production of fats

2 Glucagon

Major effects on target tissues
- Liver: increased gluconeogenesis which leads to increased glucose

25 Insulin and Glucagon

26 Role of Insulin

27 Diabetes Mellitus

- Insulin is required for glucose metabolism
  - Presence of enough insulin to meet cellular needs.
  - Ability to bind in a manner to ____________________________ the cells adequately.
- When unable to obtain energy from glucose, the body begins to use fatty stores.
  - ____________________________ and ketosis.

28 Regulation of Blood Glucose

- Hypoglycemia: low blood glucose
- Hyperglycemia: High blood glucose

- As glucose level increases, glucose begins to be lost into

- ____________________________ diuresis: Increased urination and causes dehydration that results when increased levels of glucose cannot be reabsorbed into the blood from the kidneys
- ____________________________ : glucose in urine

29 Type I Diabetes Mellitus

- Also called ____________________________ or insulin-dependent diabetes mellitus (IDDM).
- Characterized by low production of insulin.
  - Closely related to heredity.
- Results in pronounced hyperglycemia.
  - Symptoms of untreated Type I DM include polydipsia, weakness.
  - Untreated or noncompliant patients may progress to ____________________________ and diabetic ketoacidosis.

30 Type II Diabetes Mellitus

- Also called adult-onset or non-insulin-dependent diabetes mellitus (NIDDM).
- Results from decreased ____________________________ of insulin to cells.
  - Related to heredity and obesity.
  - Accounts for __________% of all diagnosed diabetes patients.
  - Less risk of fat-based metabolism.

31 Type II Diabetes Mellitus
● Results in less-pronounced hyperglycemia.
  – Hyperglycemic __________________________ nonketotic acidosis.
  – Managed with dietary changes and oral drugs to stimulate insulin production and increase ______________ effectiveness.

32 Diabetic Conditions
● Normoglycemia: ____________ - ____________ 100mg/dL
● Hypoglycemia: 40-80mg/dL
● Insulin Shock: Less than ____________ mg/dL
● Hyperglycemia: 120-400mg/dL
● Diabetic Ketoacidosis (DKA): 400-800mg/dL
● Diabetic Coma: Greater than ____________ mg/dL

33 Diabetic Emergencies
3 diabetic emergencies
● Diabetic ______________________
● Hyperglycemic Hyperosmolar Nonketotic (________________) Acidosis
● Insulin ______________________

34 Diabetic Emergencies According to Blood Glucose Level

35 Diabetic Ketoacidosis (DKA)
Causes:
● ______________ of Insulin injections
● Physiological stress such as ______________ or surgery
Pathophysiology:
  – Body metabolizes ____________________________
  – Produces ____________________________ as waste product

36 Diabetic Ketoacidosis (DKA)
Signs/Symptoms
● ____________________________ onset
● Polyuria, ____________________________
● ____________________________, dry skin
● N/V, abdominal pain
● Tachycardia
● ____________________________ respirations
● Fruity breath odor
● Decrease mental function or coma

37 Diabetic Ketoacidosis (DKA)
Management
● Obtain blood sugar level
● Maintain airway and oxygenation
● Monitor ____________________________
  – ____________________________ related arrhythmias
● IV fluids
Hyperglycemic Hyperosmolar Nonketotic (HHNK) Acidosis
- Associated with ____________________________ diabetes
- Both insulin and ____________________________ activities are present which prevents ketoacidosis
- Occurs when both:
  - Sustained hyperglycemia
    - Often over ____________ mg/dL
  - Osmotic diuresis that leads to dehydration

HHNK Acidosis
Signs/Symptoms
- ____________________________ onset
- Polyuria, polydipsia
- Warm, dry skin
- ____________________________ hypotension
- Tachycardia
- Decreased ____________________________ function or coma

HHNK Acidosis
Management
- Obtain blood sugar level
- Maintain airway and ____________________________
- Monitor ECG
  - ____________________________ related arrhythmias
- IV fluids
- Insulin

Insulin Shock (Hypoglycemia)
Causes:
- Excessive administration of ____________________________
- Not ____________________________ (not eating enough)
- ____________________________
Signs/Symptoms:
- ____________________________ onset
- Weak, rapid pulse
- Cool, ____________________________ skin
- Weakness, headache
- Decreased mental status, bizarre behavior, Coma

Insulin Shock (Hypoglycemia)
Management
- Obtain blood sugar level
- Maintain airway and oxygenation
- Monitor ECG
- IV fluids
• Administration of glucose
  – ______________________________________ glucose
  – ______________________________________ glucose
• Administration of Glucagon if IV unobtainable and Pt cannot control airway

43 D50W
• 50% Dextrose solution
• Indications: ______________________________________
• Contraindications: Allergic
• Adult dosage is ______________________________________ IV push
• Pediatric Dose: 2cc/kg of D25W IV push
  – <1yoa, 5cc/kg of D12.5W IV push
• Precaution: make sure IV is patent. IV infiltration causes ______________________________________ of skin and sc tissues

44 Glucagon
• Polypeptide hormone identical to human glucagon
• Increases blood glucose and ______________________________________ smooth muscles of the GI tract
• Acts only on liver ______________________________________, converting it to glucose
• Indications: hypoglycemia where patient cannot take oral glucose and an IV is unobtainable

45 Glucagon
• Contraindications: Allergic
• Dosage: __________-___________ mg IV, IM, or SC
• Short half life if given IV (8-13 minutes)
• Takes approximately __________-___________ minutes to reach full effects given IM and slightly longer if given SC
• Side Effects: N/V
• Repeat X 1 if patient does not regain ______________________________________ however repeat doses are not normally needed since oral glucose can then be given and the repeat dosage may not work if liver glycogen is depleted

46 Glucagon
Special Notes:
• After patient responds, watch ______________________________________
• Supplemental carbohydrates required after Glucagon to restore liver glycogen
• Comes in a dry powder and must be constituted
• Normally does not contraindicate ______________________________________
• ______________________________________ is ALWAYS the drug of choice

47 Disorders of the Thyroid Gland

48 Complications of Thyroid Disorders
• ______________________________________: the presence of excess thyroid hormones in the blood
• **hyperthyroidism**: prolonged exposure of by organs to excess thyroid hormones. Generally caused by Grave’s disease
• **hypothyroidism**: the presence of inadequate thyroid hormones in the blood
• **thyroid storm**: a condition that reflects long-term exposure to inadequate thyroid hormones, with resultant changes in structure and function

49 **Grave’s Disease**
Pathophysiology:
• Probably hereditary in nature.
• Chemical signals are generated that stimulate thyroid tissue to produce excessive hormone.

Signs & Symptoms:
• Agitation, emotional changeability, insomnia, poor heat tolerance, weight loss, weakness, dyspnea.
• Tachycardia and new-onset atrial __________________________.
• Protrusion of the eyeballs or __________________________.

50 **Goiters**

51 **Grave’s Disease**
Assessment & Management:
• Usually arise from __________________________ signs/symptoms.
  – Manage signs and symptoms.
• ______________________________________ or other corticosteroids may be beneficial

52 **Thyrotoxic Crisis (Thyroid Storm)**
Pathophysiology:
• Life- __________________________ emergency, usually associated with severe physiologic stress or __________________________ of thyroid hormone.
• Results when thyroid hormone moves from bound state to free state within the blood.

53 **Thyrotoxic Crisis (Thyroid Storm)**
Signs & Symptoms
• High fever (____________° F or higher)
• Reflected in increased activity of __________________________ nervous system.
  – __________________________, delirium or coma
  – Tachycardia and __________________________
  – Vomiting and diarrhea

54 **Thyrotoxic Crisis (Thyroid Storm)**
Assessment and Management
• Support airway, breathing, and circulation.
• Monitor closely and __________________________ transport.
• Lower body temperature
Hypothyroidism and Myxedema

Pathophysiology:
- Can be inherited or acquired.
- Chronic untreated hypothyroidism creates myxedema.
  - Thickening of ______________________________ tissue in skin and other tissues.
  - Infection, trauma, CNS depressants, or a cold environment can trigger progression to a myxedemic ______________________________.

Signs & Symptoms:
- __________, slowed mental function
- Cold intolerance, constipation, lethargy
- Absence of ______________________________, thinning hair, enlarged tongue
- Cool, pale doughlike skin
- Coma, ______________________________, and bradycardia

Assessment and Management:
- Focus on maintaining ______________________________.
- Closely monitor cardiac and pulmonary status.
- Establish IV access, but ______________________________ fluids.
- Expedite transport.

Disorders of the Adrenal Gland

Hyperadrenalism (Cushing’s Syndrome)

Pathophysiology:
- Often due to abnormalities in the anterior ______________________________ or adrenal cortex.
- May also be due to steroid therapy for nonendocrine conditions such as COPD or ______________________________.
- Long-term cortisol elevation causes many changes.
  - Atherosclerosis, ______________________________, hypertension
  - Increased response to catecholamines
  - ______________________________ and susceptibility to infection

Signs & Symptoms:
- Weight ______________________________
- “Moon-faced” appearance
- Fat accumulation on the upper back
- Skin changes and ______________________________ healing of wounds
- Mood swings
● Impaired ____________________________ or concentration

62 □ Cushing’s Syndrome

63 □ Hyperadrenalism (Cushing’s Syndrome)
Assessment & Management
● Support ABCs.
● Use ____________________________ when establishing IV access.
● Report any observations indicative of Cushing’s Syndrome to the receiving facility.

64 □ Adrenal Insufficiency (Addison’s Disease)
Adrenocortical insufficiency
Pathophysiology:
● Due to destruction of the adrenal cortex.
● Often related to heredity.
● Stress may trigger Addisonian crisis.

65 □ Adrenal Insufficiency (Addison’s Disease)
● May be related to ____________________________ therapy.
  – Sudden withdrawal can trigger Addisonian crisis.
● Addisonian crisis: form of shock associated with adrenocortical insufficiency and
characterized by profound ____________________________ and electrolyte imbalances

66 □ Adrenal Insufficiency (Addison’s Disease)
Signs & Symptoms:
● Progressive weakness, fatigue, decreased appetite, and weight loss
● ____________________________ of skin and mucous membranes
● Vomiting or diarrhea
● ____________________________ and other electrolyte disturbances
● Unexplained cardiovascular collapse

67 □ Adrenal Insufficiency (Addison’s Disease)
Assessment and Management:
● Maintain ABCs.
● Closely monitor cardiac and ____________________________ status.
● Obtain blood glucose level and treat for ____________________________ if present.
● Establish IV and provide ____________________________ fluid resuscitation.
● Expedite transport.