Chapter 43

Drugs for Pituitary, Thyroid, and Adrenal Disorders

Endocrine System
• Consists of glands that secrete hormones
• Maintains homeostasis using hormones as chemical messengers
  – Secreted in response to changes in internal environment
• Hormone release commonly controlled by negative feedback
• One hormone may control another

Negative Feedback
• Common for last hormone in a pathway to provide feedback
• Turns off secretion from first hormone
• Prevents overresponses by endocrine system

Hypothalamus and Pituitary Glands
• Control many other glands
• Hypothalamus secretes releasing hormones
  – Direct anterior pituitary gland as to which hormones should be released
• Posterior pituitary releases hormones.
  – In response to nerve signals from hypothalamus
Hormone Pharmacotherapy

- Hormones used as
  - Replacement therapy
  - Antineoplastics
  - Natural therapeutic effects
    - Exaggerated response or suppression of body defenses
- Hormone blockers used to inhibit actions of certain hormones

Pharmacotherapy with Pituitary and Hypothalamic Hormones

- Only a few hormones have clinical application
  - Difficult and expensive to obtain
  - Usually more effective to give hormone that directly affects secretion
  - Commonly used are
    - Prolactin, oxytocin
    - Corticotropin, growth hormone
    - Antidiuretic hormone (ADH)

Growth Hormone (GH)

- Stimulates growth and metabolism
- Deficiency results in dwarfism
- Recombinant DNA technology
  - Somatrem (Protropin) and somatropin (Humatrope)
  - Recently approved to treat small stature associated with normal levels of growth hormone (GH)

Growth Hormone (GH) (continued)

- Excess results in acromegaly
  - Synthetic growth hormone antagonist
    - Octreotide (Sandostatin), related to somatostatin
  - Growth hormone receptor antagonist
    - Pervisomant (Somavert)

Antidiuretic Hormone (ADH)

- Conserves water in body
- Diabetes insipidus is caused by deficiency of ADH
- Most common form of ADH: desmopressin (DDAVP)
  - Long duration of action (20 hours)
  - Forms: nasal spray, oral, intravenous, subcutaneous

Antidiuretic Hormone (ADH) (continued)

- Other drugs: vasopressin (Pitressin) and lypressin (Diapid)
  - Short duration of action (2–8 hours)
  - Only given via intramuscular or subcutaneous routes
Thyroid Gland

- Secretes thyroxine (T4) and triiodothyronine (T3)
  - Control basal metabolic rate and affect every cell in body
- Parafollicular cells in thyroid secrete calcitonin
  - Responsible for calcium homeostasis

Thyroid Gland (continued)

- Follicular cells secrete thyroid hormone
  - Thyroxine (T4) and triiodothyronine (T3)
  - Iodine essential for synthesis of T4 and T3
  - Negative-feedback loop
    - Low tyroxine levels signal hypothalamus to release thyroid-releasing hormone (TRH).
    - Signals pituitary to release thyroid-stimulating hormone (TSH)

Symptoms of Hypothyroidism in Adults (Myxedema)

- Early symptoms are general weakness, muscle cramps, and dry skin
- More severe symptoms include
  - Slurred speech, bradycardia, weight gain
  - Decreased sense of taste and smell
  - Intolerance to cold environments
- Elevated TSH with diminished T3 and T4 levels

Symptoms of Hyperthyroidism

- Increased body metabolism
- Tachycardia, weight loss
- Elevated body temperature, anxiety

Hypothyroidism (myxedema)

- Most common cause is chronic autoimmune thyroiditis (Hashimoto’s disease)
- Lab studies
  - Elevated thyroid-stimulating hormone (TSH)
  - Decreased T3 and T4
- Treatment
  - Natural or synthetic thyroid hormones
    - Especially levothyroxine (T4)
Hyperthyroidism

- Most common cause is Grave’s disease
- Goal is to lower activity of thyroid

Hyperthyroidism (continued)

- Treatment
  - Administer thioamides, which decrease activity of thyroid gland
    - Propylthiouracil (PTU) and methimazole (Tapazole)
  - Radioactive iodide that kills overactive thyroid cells
    - Sodium iodide-131, Lugol’s solution

Adrenal Cortex

- Secretes glucocorticoids
  - Mobilize body for long-term stress
  - Influence carbohydrate, lipid, and protein metabolism in most cells
- Secretes mineralocorticoids
  - Aldosterone promotes sodium reabsorption and potassium secretion
- Secretes gonadocorticoids
  - Male sex hormones (androgens)

Addison’s Disease

- Primary adrenocortical insufficiency
- Symptoms
  - Hypoglycemia, fatigue, hypotension
  - Increased skin pigmentation
  - GI disturbances: anorexia, vomiting, diarrhea
  - Low plasma cortisol, accompanied by high plasma ACTH levels

Cushing’s Syndrome

- Caused by long-term administration of glucocorticoids
- Signs and symptoms
  - Moon face, buffalo hump, mood and personality disorders

Control of Glucocorticoids

- Hypothalamus releases corticotropin-releasing factor (CRF)
  - Causes adrenocorticotropic hormone (ACTH) to be secreted by pituitary
- Adrenal cortex releases glucocorticoids
- When cortisol level rises, negative-feedback mechanism shuts off further release of glucocorticoids
Pharmacotherapy of Adrenocorticotropic Hormone (ACTH)

- ACTH and related agents rarely used as medications
- Must be given parenterally and have many side effects
- Primary use is to diagnose adrenal disorders

Pharmacotherapy of Adrenocortical Insufficiency

- May be acute or chronic
- Glucocorticoids prescribed
  - Primary (Addison’s disease), secondary adrenocortical insufficiency
  - Allergies, neoplasms, wide variety of other conditions

Antiadrenal Drugs

- Used to treat severe Cushing’s syndrome
  - Occurs with prolonged glucocorticoid therapy
    - Inhibits corticosteroid synthesis
  - Antiadrenal drugs not curative
    - Use usually limited to three months of therapy

Role of the Nurse

- Monitor client’s condition
- Provide client education
- Obtain medical, surgical, drug history
- Assess lifestyle and dietary habits
- Obtain descriptions of symptomology and current therapies

Antidiuretic Hormone Therapy for ADH Deficiency

- Assess for electrolyte imbalances
- Assess for changes in specific gravity and fluid intake
- Monitor serum sodium and potassium levels
- Monitor urinary specific gravity, routine urinalysis
- Monitor body weight and fluid intake/output
- Assess vital signs, especially blood pressure and pulse
Antidiuretic Hormone Therapy for ADH Deficiency (continued)

- Assess neurological status
  - Symptoms of headache
  - Changes in mental status: drowsiness, confusion
- Advise clients to avoid alcohol

Thyroid Hormone Therapy

- Assess client's weight and vital signs
- Assess tachycardia, irregular heart rate, hypertension
- Assess nervousness, weight loss, diarrhea, heat intolerance

Thyroid Hormone Therapy

- Monitor clients with impaired renal function closely
- Monitor for excess fatigue, slow speech, hoarseness, or slow pulse
  - May indicate underdosage

Hypothyroidism Therapy

- Assess for signs and symptoms of hypothyroidism
- Assess for signs of jaundice; monitor liver enzymes
- Assess for bleeding and blood dyscrasias, such as agranulocytosis

Hypothyroidism Therapy

- Client teaching
  - Avoid children and pregnant women for one week after administration of radioactive iodine (I-131)
  - Limit close physical contact with others for a few days

Glucocorticoid Therapy for Adrenocortical Insufficiency

- Assess vital signs for temperature and blood-pressure elevations
- Monitor potassium, T3, T4, glucose levels
- Clients on long-term glucocorticoid therapy
  - Monitor for osteoporosis and elevated serum cholesterol levels
- Assess for signs and symptoms of Cushing’s syndrome
**Antiadrenal Therapy for Adrenocortical Insufficiency**
- Assess and monitor lab values
  - Platelet count, bilirubin, hepatic-function tests, and prothrombin
- Assess for jaundice, bruising, bleeding
- Monitor client’s stress level
- Monitor for orthostatic hypotension and dizziness
- Assist with ambulation
- Caution client to change positions slowly

**Anterior Pituitary Agents**
- Prototype drug: vasopressin injection (Pitressin)
- Mechanism of action: causes renal collecting tubules to increase their permeability to water
  - Enhances water reabsorption

**Anterior Pituitary Agents (continued)**
- Primary use: treatment of diabetes insipidus
- Adverse effects: hypertension
  - Can precipitate angina episodes and myocardial infarction in clients with coronary artery disease
  - Excessive fluid retention can cause water intoxication

**Thyroid Agents**
- Prototype drug: levothyroxine (Synthroid)
- Mechanisms of action: same as those of thyroid hormone
- Primary use: drug of choice for replacement therapy in clients with low thyroid function
- Adverse effects: hyperthyroidism, palpitations, dysrhythmias
  - Anxiety, insomnia, weight loss, heat intolerance
  - Menstrual irregularities and osteoporosis in women

**Antithyroid Agents**
- Prototype drug: propylthiouracil (PTU)
- Mechanism of action: to interfere with synthesis of T3 and T4 in thyroid gland
  - Also prevents conversion of T4 to T3 in target tissues
- Primary use: administered to clients with hyperthyroidism
- Adverse effects: symptoms of hypothyroidism
  - Rash and transient leucopenia most common side effects
  - Small percentage of clients experience agranulocytosis
Adrenal Drugs—Glucocorticoids

- **Prototype drug:** hydrocortisone (Aerosol-HC, Alphaderm)
- **Mechanism of action:** acts as synthetic corticosteroid
- **Primary use:** drug of choice for treating adrenocortical insufficiency

Adrenal Drugs—Glucocorticoids (continued)

- **Adverse effects:** sodium and fluid retention
  - CNS effects: insomnia, anxiety, headache, vertigo, confusion, depression
  - Hypertension, tachycardia, peptic ulcer disease, Cushing’s syndrome
  - Can occur with long-term therapy

Hypothalamic and Pituitary Agents

- Few of these used in pharmacotherapy
  - Difficult to obtain and expensive
- More effective to give drugs that *directly* affect secretion at target organs
- Two pituitary hormones, prolactin and oxytocin
  - Affect female reproductive system

Hypothalamic and Pituitary Agents (continued)

- Corticotropin affects adrenal gland
- Growth hormone and antidiuretic hormone have most clinical utility

Thyroid Drugs

- Thyroid disorders common; drug therapy often indicated
- Dose highly individualized; requires careful, periodic adjustment
- Hypothyroidism treated with natural or synthetic thyroid agents

Antithyroid Drugs

- Medications used to treat cause of hyperthyroidism
  - Also used to relieve distressing symptoms
- Goal is to lower activity of thyroid gland
Selected Glucocorticoids

- Adrenal glands secrete hormones affecting every body tissue
- Specific pharmacotherapy depends on which portion of adrenal gland is responsible
- Chronic corticosteroid insufficiency requires replacement with glucocorticoids

Selected Glucocorticoids (continued)

- Goal of replacement therapy is to reach appropriate level of hormones in blood
- Adrenal insufficiency also may require mineralocorticoid
- Glucocorticoids also prescribed to suppress inflammatory and immune responses

Antiadrenal Therapy for Adrenocortical Insufficiency

- Used to inhibit metabolic conversion of cholesterol to adrenal corticosteroids
- Not curative; use is temporary

Clients Receiving Thyroid Replacement Therapy

- Assessment
  - Obtain complete health history.
  - Obtain complete physical examination.
  - Assess for presence and history of symptoms of hypothyroidism.
  - Obtain ECG and laboratory studies, including T4, T3, and serum TSH levels.

Clients Receiving Thyroid Replacement Therapy

- Nursing diagnoses
  - Activity intolerance, related to disease process
  - Fatigue, related to impaired metabolic status
  - Deficient knowledge, related to drug therapy
  - Ineffective health maintenance, related to side effects of drug

Clients Receiving Thyroid Replacement Therapy

- Planning—client will
  - Exhibit normal thyroid hormone levels
  - Report decrease in hypothyroid symptoms
  - Experience no significant adverse effects from drug therapy
  - Demonstrate understanding of hypothyroidism and need for lifelong therapy
Clients Receiving Thyroid Replacement Therapy

• Implementation
  – Monitor vital signs
  – Monitor for decreasing symptoms related to hypothyroidism and to hyperthyroidism
  – Monitor T3, T4, TSH levels

• Evaluation
  – Client’s thyroid hormone levels are normal
  – Client’s hypothyroid symptoms are decreased
  – Client is free from significant adverse effects of drug therapy
  – Client verbalizes understanding of hypothyroidism and need for lifelong therapy

Clients Receiving Thyroid Replacement Therapy (continued)

• Implementation (continued)
  – Monitor blood-glucose levels, especially with diabetes mellitus
  – Provide supportive nursing care to cope with symptoms
  – Monitor weight at least weekly
  – Monitor client for signs of decreased compliance with therapeutic regimen

• Planning
  – Exhibit decrease in symptoms of hyperthyroidism
  – Exhibit normal thyroid hormone levels
  – Exhibit no adverse effects of drugs, such as agranulocytosis or GI distress
  – Demonstrate understanding of disease process and health maintenance strategies

Clients Receiving Antithyroid Therapy

• Assessment
  – Obtain complete health history
  – Obtain complete physical examination
  – Assess for presence and history of hyperthyroidism
  – Obtain laboratory studies
    • T3, T4 levels, TSH level, ECG, CBC

• Nursing diagnoses
  – Risk for infection, related to drug-induced agranulocytosis
  – Risk for injury, related to side effects of drug therapy
  – Ineffective health maintenance, related to adverse GI effects
  – Deficient knowledge, related to drug therapy

Clients Receiving Antithyroid Therapy

• Planning—client will
  – Exhibit decrease in symptoms of hyperthyroidism
  – Exhibit normal thyroid hormone levels
  – Exhibit no adverse effects of drugs, such as agranulocytosis or GI distress
  – Demonstrate understanding of disease process and health maintenance strategies
Clients Receiving Antithyroid Therapy

• Implementation
  – Monitor vital signs
  – Monitor thyroid-function tests
  – Monitor for signs of infection, including CBC and WBC count
  – Monitor weight at least weekly
  – Monitor for drowsiness

• Evaluation
  – Client demonstrates decreased symptoms of hyperthyroidism
  – Client demonstrates normal serum thyroid levels
  – Client is free of adverse effects, such as agranulocytosis or GI distress
  – Client states understanding of disease process and health-maintenance strategies

Clients Receiving Antithyroid Therapy (continued)

  – Monitor for gastrointestinal distress
  – Monitor for symptoms related to hyperthyroidism or hypothyroidism
  – Monitor for activity intolerance
  – Monitor dietary intake
  – Monitor client’s response to drug therapy

Clients Receiving Systemic Glucocorticoid Therapy

• Assessment
  – Obtain complete health history
  – Obtain complete physical examination
  – Determine reason medication is being administered
  – Obtain serum sodium and potassium levels
    • Also hematocrit and hemoglobin levels
    • Blood-glucose level, blood urea nitrogen (BUN), creatinine levels

• Nursing diagnoses
  – Risk for infection, related to immunosuppression
  – Risk for injury, related to side effects of drug therapy
  – Deficient knowledge, related to drug therapy
  – Interrupted breast-feeding, related to drug therapy

• Planning—client will
  – Exhibit decrease in symptoms for which drug is being given
  – Exhibit no symptoms of infection
  – Demonstrate understanding of drug’s action, drug administration, and side effects
  – Adhere to drug and laboratory studies regimen
Clients Receiving Systemic Glucocorticoid Therapy

- Implementation
  - Monitor vital signs
  - Monitor for infection and protect client from potential infections
  - Monitor client’s compliance with drug regimen
  - Monitor for symptoms of Cushing’s syndrome
  - Monitor blood-glucose levels

Clients Receiving Systemic Glucocorticoid Therapy (continued)

- Monitor skin and mucous membranes for lacerations, abrasions, or break in integrity
- Monitor GI status for peptic ulcer development
- Monitor serum electrolytes
- Monitor changes in musculoskeletal system
- Monitor emotional stability

Clients Receiving Systemic Glucocorticoid Therapy

- Evaluation
  - Client states that symptoms have decreased
  - Client is free from signs of infection
  - Client states understanding of drug’s action, administration, and side effects
  - Client verbalizes importance of adhering to drug and laboratory studies regimen

Selected Hypothalamic and Pituitary Agents

Table 43.2 Selected Hypothalamic and Pituitary Agents

Thyroid and Antithyroid Drugs

Table 43.3 Thyroid and Antithyroid Drugs

Selected Glucocorticoids

Table 43.4 Selected Glucocorticoids