Chapter 29 Clients with Endocrine System Disorders
Structure and Function of the Endocrine System

Endocrine System
° Ductless glands secrete hormones directly into the blood; hormones circulate to target cells in the body [corresponds to Figure 29-1]. Maintains and achieves homeostasis (balance) in the body.
  o Pituitary
  o Pineal
  o Thyroid
  o Parathyroids
  o Thymus
  o Pancreas
  o Adrenals
  o Ovaries
  o Testes
° Endocrine gland functions [corresponds to Table 29-1]
° Glands can function as endocrine and exocrine glands. (Exocrine glands, like sweat glands, secrete substances through ducts to epithelial surface inside the body or on the skin.)
  o Pancreas has exocrine and endocrine functions:
    ↑ Releases enzymes through duct into the duodenum to break down foods
    ↑ Releases insulin directly into the bloodstream to help the body use glucose.
° Hormones
  o Chemical messengers function individually or with other hormones
  o Target cells influenced either by neurotransmitters or hormones.
  o Tropic or indirect-acting hormones
    • Secreted by one gland and target another endocrine gland, stimulating growth and secretion.
    • Example thyroid stimulating hormone secreted by the pituitary.
      ↑ Stimulates the target cells in thyroid to release hormones.
  o Direct acting hormones
    • Have specific local effect.
    • Example insulin, released specifically to affect the level of glucose in the blood.

Pituitary and Hypothalamus [corresponds to Figure 29-2]
° Pituitary called “master gland” of the endocrine system, but is controlled by the hypothalamus at the base of the brain.
° Hypothalamus - command center for the autonomic nervous system (involuntary activities)
  o Produces vasopressin and oxytocin; stores them in posterior pituitary.
° Negative feedback
  o When the blood level of a certain hormone is high, the hypothalamus sends message to decrease production of that hormone. The gland
responds to that inhibiting factor, and the correct blood level of the hormone is maintained.

- If the hormone level (in the circulating blood) is low, hypothalamus sends message to release more hormone.

° Pituitary or hypophysis
- Small, powerful, well protected at base of skull behind the base of the nose, connected by a projection to hypothalamus.
- Two parts:
  - Anterior pituitary (adenohypophysis), 75%
  - Posterior pituitary (neurohypophysis) 25%.
- Connecting strip between parts = pars intermedia.

° Anterior pituitary (Adenohypophysis)
- Secretes four tropic hormones
  - Thyroid stimulating hormone (TSH), targets thyroid gland,
  - Adrenocorticotropic hormone (ACTH), stimulates adrenal gland.
  - Follicle stimulating hormone (FSH), targets ovaries
  - Luteinizing hormone (LH), targets testes.
  - Term: gonadotropins.
- Secretes direct hormone: growth hormone (GH), called somatotropin
  - Influences bone, muscle, and other tissues
  - Indirectly increases blood glucose levels.

° Posterior pituitary (Neurohypophysis)
- Releases antidiuretic hormone (ADH) and oxytocin, which are manufactured by the hypothalamus and stored in the posterior pituitary.
- ADH- needed for water reabsorption by kidneys.
- Oxytocin stimulates the prostate in males; and uterus and mammary glands in females

Pineal gland
- Smallest endocrine gland, secretes melatonin, thought to affect thyroid, adrenal cortex, gonads, and pituitary.
- Acts as a matrix for calcium, inhibits secretions of gonadotropins.
- Hypersecretion of pineal gland hormones causes a delay in puberty.
- Hyposecretion results in early puberty.
- Related to body clock mechanism
  - Increased melatonin leads to sleepiness
  - Seasonal affective disorder – treatment with light

Thyroid gland – shaped like butterfly, sits over trachea
- Secretes three hormones:
  - Thyroxine (T₄)
  - Triiodothyronine (T₃)
  - Calcitonin (reroutes blood calcium to bones)
- Iodine needed for thyroid to make T₄ and T₃; now added to table salt.
- Thyroxine (T₄) and Triiodothyronine (T₃):
  - Regulate the rate of metabolism
  - Both regulate normal growth and development

Parathyroids
Embedded in the posterior of thyroid, secrete parathormone (PTH), which:
  - Maintains calcium and phosphate balance
  - Is antagonist (“off-switch”) to calcitonin
  - Targets the bones, kidneys and intestinal cells to increase blood calcium level (needed for normal neuromuscular activity, cell permeability)
  - When PTH levels rise, phosphate is excreted and blood level of phosphate decreases.

Thymus gland
  - Two lobes beneath the sternum.
  - Larger and more active in children, begins to atrophy at puberty.
  - Produces:
    - **Thymosin** - essential role in developing immune system, causes T-lymphocytes to mature.
    - **Thymin**, blocks transmission of neuromuscular nerve impulses.
      - Increased levels of thymin produce severe muscle weakness found in myasthenia gravis

Pancreas
  - Exocrine function – digestive enzymes to duodenum through pancreatic duct
  - Endocrine function - produce and release insulin and glucagon
  - Islets of Langerhans imbedded in pancreas, secrete 3 hormones
    - **Glucagon**, secreted by alpha cells, targets the liver to release glycogen, which causes increase in blood sugar
    - **Insulin**, produced by beta cells, moves glucose out of blood and into cells. Insulin is antagonist to glucagon (helps reduce blood sugar)
    - **Somatostatin**: causes hypoglycemic (lowered blood sugar) effect, interferes with release of growth hormone and glucagon.

Adrenal glands (suprarensals) - on top of kidneys.
  - Inner core = adrenal medulla.
  - Adrenal cortex = outer portion, secretes three groups of hormones, called *corticosteroids*.
    - Glucocorticoids, mainly cortisol (hydrocortisone), involved in carbohydrate, protein, and fat metabolism and body’s reactions to stress; stimulate liver to release glucose when energy is needed.
      - Targeted by ACTH from anterior pituitary
    - Mineralocorticoids, mainly aldosterone, regulate how electrolytes are processed
    - Gonadocorticoids (sex hormones) for male and female
  - Adrenal medulla = inner portion, secretes **epinephrine** (adrenalin) and **norepinephrine** (noradrenalin)
    - Epinephrine (75% of secretion) and norepinephrine (25%) are catecholamines, neurotransmitters released in “flight or fight reaction”
      - Epinephrine (adrenalin) - inhibits GI activity, constricts arterioles in skin, dilates blood vessels to muscles, liver, bronchus and heart, increases body metabolism, and raises blood glucose
Norepinephrine - causes contraction of blood vessels and increase in BP, increases heart activity, inhibits GI action, and dilates the pupils for wider vision range.

Effects of norepinephrine last about ten times longer than epinephrine; it is more slowly removed from the blood.

Pituitary Disorders

- Anterior pituitary disorders – hyper- or hypopituitarism
  - Hyperpituitarism: pituitary secretes too much growth hormone
    - Gigantism – occurs in children prior to closure of epiphyses
      - Caused by tumor of pituitary or malfunction of hypothalamus
      - Reach a height of 7 feet or more without treatment.
      - Manifestations: accelerated skeletal growth, pain, headache, and muscle weakness, cardiomegaly (enlarged heart), hepatomegaly (enlarged liver).
    - Acromegaly – occurs when hyperpituitarism starts in adulthood
      - Usually caused by a benign tumor or hypothalamic malfunction
      - Manifestations: Height does not change because epiphyses have closed, long bones widen, feet and hands enlarge. Face changes to coarse appearance with bulbous nose, thickened lips, protruding forehead and jaw.
        - Enlarged internal organs
        - Muscle weakness and arthritis symptoms
        - Difficulty chewing and swallowing
        - Male impotence or amenorrhea
        - Visual disturbances and headaches – if tumor present
        - Diabetes secondary result, because growth hormone increases blood glucose levels
      - Tests: growth hormone serum levels, X-rays, and scans
    - Treatment of hyperpituitarism:
      - Irradiation to shrink tumor
      - Surgery, tumor removed through sphenoid (transsphenoidal hypophysectomy). Client needs lifelong hormone therapy.
        - Removal of tumor stops soft tissue changes, but bone changes are permanent.
      - Bromocriptine (Parlodel) may be used to decrease GH levels but has no effect on tumor size.

- Hypopituitarism – dwarfism – occurs with insufficient growth hormone secretion
  - Usually caused by tumor of pituitary gland
  - Manifestations: child’s growth stunted, sexual development may be delayed
  - Diagnosis by serum GH levels, x-rays and scans to detect tumor, GH stimulation test
  - Treatment: growth hormone replacement by injection until child reaches short average stature; surgery if tumor is present
- Nursing care for pituitary disorders: always report deviation from normal growth in child; assess adults for symptoms of acromegaly; give injections as ordered; provide emotional support to family.

- Posterior pituitary disorders
  - Syndrome of inappropriate antidiuretic hormone (SIADH)
    - Occurs when posterior pituitary secretes too much antidiuretic hormone (ADH):
      - Too much water is reabsorbed by kidneys into bloodstream, leading to:
        - Fluid overload of bloodstream
        - Dilution of blood
        - Decreased osmolarity.
    - Possible causes of SIADH
      - Brain tumor
      - Certain cancers (e.g., lung, duodenum, and pancreas release ADH-like substance)
      - Some medications (e.g., tricyclic antidepressants)
    - Manifestations:
      - Weight gain without edema
      - Normal sodium levels looking like hyponatremia because the blood is so dilute
      - Increased blood pressure, muscle weakness, nausea, and headache
      - Concentrated urine because kidneys reabsorb more fluid than is needed; urine output is decreased; urine specific gravity at 1.030 or above
      - Cerebral edema, lethargy, seizures, coma, and even death caused by excess circulating fluid affecting the brain
    - Diagnosis of SIADH by:
      - Serum and urine levels of sodium
      - Osmolarity concentrations
      - “Water load test” (client retains water when SIADH is present)
      - Client is checked for other possible sites of ADH secretion.
    - Treatment of SIADH:
      - Strict fluid restriction, hypertonic saline fluids to counteract hyponatremia; diuretics, such as Lasix; declomycin to block the action of ADH
      - Surgery to remove tumor if discovered
  - Diabetes Insipidus (DI)
    - Occurs with insufficient secretion of antidiuretic hormone; kidneys do not reabsorb enough water; large output of dilute urine results.
    - Possible causes:
      - Tumor in pituitary gland
      - Intake of glucocorticoid medications
      - Intake of alcohol
      - Head trauma
Manifestations of DI:
- 3 to 15 liters of urine in 24 hours
- May drink large amounts of fluid
- May have intense desire for ice water
- Urine osmolarity low, serum osmolarity high
- Urine specific gravity so dilute it resembles water at 1.000
- May have signs of dehydration,

Diagnosis of DI:
- Based on symptoms and serum osmolarity levels; urine specific gravity < 1.005; scans to detect tumor; possible “water deprivation test”
- Untreated DI May lead to hypovolemic shock and death.

Treatment of DI:
- Replacement of ADH
  ↑ Aqueous vasopressin (Pitressin), synthetic
  ↑ Desmopressin (DDAVP), a nasal spray
- Sodium restriction
- Electrolytes and fluids replaced by IV with 0.45% sodium chloride.
- Diabenese (chlorpropamide) to stimulate partially functioning pituitary

Insufficient oxytocin release in labor
- Oxytocin initiates contractions in uterus and mammary glands; hyposecretion in labor is treated with synthetic hormone (Pitocin)

General nursing care of clients with pituitary disorders:
- Assess weight gain or loss, I&O, headaches or visual disturbances; menstrual irregularities or impotence; child’s percentile on growth charts, enlargement of the skull, hands, and feet (acromegaly) in adults.
- Maintain fluid volume balance.
- Monitor appropriate growth and development for age.
- Provide medication as ordered.
- Teach about disorder and medical regimen.
- Implement safety measures for clients with visual disturbances, eating difficulties, and muscle weakness.
- Monitor blood glucose levels & neurologic status q 2-4 hr.

Nursing care after removal of tumor through sphenoid (transphenoidal hypophysectomy):
- Monitor neurological status and dressing (report increased drainage).
- Teach client to avoid sneezing, coughing, bending and straining; provide stool softeners or cough medication as ordered.

Nursing care of clients with SIADH:
- Auscultate lung sounds and measure weight (gain and moist lung sounds can signal fluid volume excess).
- Maintain fluid restriction; offer oral care, ice chips, and hard candy.
- Monitor serum sodium and urine values, urine specific gravity, and osmolarity. If the client requires sodium, offer broth, soft drinks, and tomato juices.
Be alert for diminishing level of consciousness or seizure activity.

Nursing care of clients with DI:
- Watch for signs of dehydration.
- Check VS often (decreasing BP & increasing heart rate may signal hypovolemic shock).
- Monitor urine specific gravity, urine and serum osmolarity, electrolytes, and LOC and keep physician notified of changes.
- Reinforce importance of low sodium diet.
- Encourage clients to discuss feelings. Provide support and comfort measures. Help client & family understand medication plan and develop positive coping strategies.
- Provide information about DI and support groups.

Thyroid Disorders
- Primary hyperthyroidism (Graves’ disease) – oversecretion of T₃ and/or T₄, which increases metabolic rate
  - Caused by tumor, goiter (enlarged thyroid), or autoimmune disorder
  - Manifestations [corresponds to Figure 29-3]:
    - Tachycardia, palpitations, hypertension, heat intolerance; nervousness, tremor, emotional lability
    - Exophthalmos
    - Dysrhythmias and death (if untreated)
    - Weight loss in spite of increased appetite; fatigue, weakness, diarrhea and diaphoresis
    - Elevated serum levels of T₃ and T₄
    - Thyroid-stimulating hormone is low in primary hyperthyroidism.

- Treatment of hyperthyroidism:
  - Antithyroid medications, e.g. Tapazole [corresponds to Table 29-2]
    - Do not affect hormones already stored for release.
  - Iodine medications, e.g. potassium iodide
    - To suppress release of thyroid hormones, decrease vascularity of the gland prior to surgery.
  - Radioactive Iodine (RAI or I¹³¹) destroys thyroid cells to decrease hormone produced.
    - Client may require lifelong hormone replacement therapy.
  - Subtotal or total thyroidectomy if medications cannot control hyperthyroidism, followed by lifelong hormone replacement.

- Thyrotoxicosis (thyroid storm or thyroid crisis)
  - A severe, life threatening hyperthyroidism – can occur if clients are left untreated or after thyroid surgery
  - Symptoms tachycardia, hypertension, elevated temperature.
  - Treatment: treated immediately with antithyroid medications, beta-adrenergic blockers for hypertension, and antipyretic medication for the fever. If not treated, progresses quickly to seizures and coma.

- Thyroid surgery complications:
  - Thyrotoxicosis (see above)
Respiratory distress due to edema or internal bleeding might require emergency tracheostomy at bedside
  - Hemorrhage, usually within first 48 hours, with signs of shock or excessive bleeding on dressing or behind head
  - Nerve damage to larynx causing changes in voice

Unintended parathyroid removal
  - Parathyroids regulate calcium levels so removal causes hypocalcemia. Keep IV calcium gluconate or calcium chloride available. Hypocalcemia seen by
    ↑ Tetany (muscular spasms) is cardinal sign removal of parathyroid glands occurred.
    ↑ Positive Chvostek’s sign or positive Trousseau’s sign [corresponds to Figure 29-5]

Hypothyroidism (myxedema)
  - Thyroid gland does not make enough thyroid hormone
  - Cretinism - hypothyroidism occurring in infancy; may be due to a congenital anomaly
  - Primary hypothyroidism more common in women 30-60 years old
  - Hypothyroidism can result from
    - Autoimmune disorder (Hashimoto's thyroiditis)
    - Iodine deficiency, antithyroid medications
    - Thyroidectomy
  - Manifestations of hypothyroidism:
    - Goiter - enlargement (hyperplasia) of thyroid gland
    - Slow metabolism, lethargy, personality changes, dull facial expressions, and periorbital edema, weight gain, constipation, weakness, hair loss, non-pitting edema
    - Bradycardia, hypotension, and dysrhythmias
    - Intolerance to cold
  - Treatment of hypothyroidism:
    - Administration of thyroid drugs, e.g., levothyroxine (Synthroid)
    - NOTE: Treatment of hypothyroidism with thyroid hormones can cause symptoms of hyperthyroidism if dose too high.

Myxedema coma – severe form of hypothyroidism that occurs most often in winter and to older clients (> 60 years)
  - Can be life threatening, requires immediate medical intervention; lethargy progresses to hypothermia and coma. If untreated, major body systems shut down.
  - Diagnosis of myxedema by low serum levels of T3 and T4 and elevated thyroid stimulating hormone
  - Immediate treatment involves:
    ↑ Establishing patent airway
    ↑ Providing cardiac support
    ↑ Administering intravenous hormone replacement (levothyroxine starting at low dose)

Nursing care for clients with thyroid disorders:
Monitor VS for changes and heart sounds for arrhythmias.
Monitor lab values daily and report abnormal values.
Weigh client daily.
Check environment often for client comfort.
Support client self-esteem and encourage client to verbalize feelings.

Nursing care for clients with hyperthyroidism:
- Monitor intake and offer high-calorie, high-protein diet & snacks; instruct client to avoid high-roughage foods & caffeine.
- Provide rest periods, instruct in relaxation techniques.
- Offer cool showers and change of clothing for excessive perspiration.
- Assess visual disturbance and report.
- Reinforce treatment plan.
- After radioactive isodine (RAI), increase fluid intake to clear iodine from body. Explain why limited client contact is necessary. Instruct client to flush twice after using toilet. Use plastic utensils and disposable dishes.
- Observe clients for evidence of exophthalmos.

Nursing care for clients with hypothyroidism:
- Monitor cholesterol levels for changes.
- Offer high-fiber, low-calorie diet with adequate fluids; administer stool softeners and laxatives as ordered.
- Promote activity to client’s level of ability.
- Monitor orientation level and reorient as needed.
- Monitor for periorbital edema.
- Instruct client to be alert for signs of hyperthyroidism (dosage change can cause opposite imbalance).
- Reinforce instructions about disease and therapy (lifelong hormone replacement treatment).

Thyroid cancer
- Rare, but risk increases with age.
- Treated with surgery to remove the gland followed by lifelong hormone replacement therapy
- Nursing care after thyroid surgery:
  - Monitor VS frequently, especially respiratory rate, depth, effort; restlessness may be early sign of respiratory distress
  - Assess throat dressing for drainage; check back of neck also.
  - Instruct client to move head with support to prevent hyperextension
  - Monitor serum calcium; monitor closely for tetany, numbness, and tingling of extremities

Parathyroid Disorders
- Hypoparathyroidism – deficient production of parathormone (PTH), affects kidney regulation of calcium & phosphates
  - Calcium levels low (absorption through intestines decreased); normal calcium range 8.5-10.0 mg/dL
  - Phosphate levels high; normal range 3.0-4.5 mg/dL
  - Usually caused by accidental removal of parathyroids during surgery
  - Manifestations:
• Tetany, positive Chvosstek’s and Trousseau’s signs; tremors, tingling and numbness in lips & extremities from low calcium level
• Possible abdominal cramps, hair loss, dry skin, and depression; cardiac arrhythmias
• With progression, bronchospasms, laryngeal spasms, convulsions, and death
  ° Treatment:
    • IV calcium gluconate, oral calcium, and vitamin D supplements
    • Possibly thiazide diuretics to reduce calcium excretion in urine
    • Temporary aid: have client breathe into paper bag (acidosis increases serum calcium ionization)

° Hyperparathyroidism - overactivity of parathyroids, increased secretion of parathormone.
  • Calcium increased, phosphorus decreased (excreted in urine); calcium moves out of bones and into bloodstream.
  • Cause: usually benign tumor or hyperplasia of the gland.
  • Occurs more often in older adults and in women.
  ° Manifestations:
    • Low back pain, pathologic fractures, renal calculi
    • Decreased muscle tone and increased muscle weakness
    • Possible polyuria, abdominal pain, nausea, vomiting, and constipation; depression, psychosis, and coma
    • Arrhythmias and hypertension can progress to cardiac arrest.
  ° Diagnosis:
    • High calcium and parathormone, low levels of phosphorus
    • X-rays may show bone density changes.
  ° Treatment for hypoparathyroidism:
    • IV and oral fluids given to dilute the blood and lower calcium level
    • Diuretics, e.g. Lasix, to increase calcium excretion in urine
    • Calcitonin to prevent calcium release from bones into blood
    • Mithramycin to lower serum calcium levels. NOTE: only 3 doses given because of toxicity of this drug.
    • Surgery possible if tumor is present

° Nursing care for clients with parathormone disorders:
  ° Monitor VS at least q 4 hr (more often with unstable client); assess for irregular pulse, tachycardia/bradycardia, hypotension/hypertension.
  ° Monitor lab values daily and report abnormal electrolyte values.
  ° Check labs for hypercalcemia, hypocalcemia, hyperphosphatemia, hypophosphatemia, increased or decreased hormone levels of $T_3$, $T_4$, and parathormone.
  ° Encourage client to verbalize feelings and anxieties.

° Nursing care for hypoparathyroidism:
  ° Monitor VS; listen to respirations for signs of bronchospasm or laryngospasm.
  ° Monitor electrolyte levels, especially calcium.
Observe for manifestations of tetany; assess for Chvostek’s sign and Trousseau’s sign.

Help client to select foods high in calcium and avoid foods high in phosphorus. Teach client about the disease.

Ensure that IV calcium and a tracheostomy set are available for emergency situations.

Nursing care for hyperparathyroidism:

- Monitor for safety related to muscle weakness and pathologic fractures.
- Encourage rest periods.
- Offer frequent oral fluids and record I&O.
- Monitor serum calcium and phosphorus.
- Monitor client’s mental status.
- Help client to select foods high in phosphorus and avoid foods high in calcium.
- Medicate client for nausea and pain as ordered.

Pancreatic disorders

- Regulation of blood glucose by pancreas [corresponds to Figure 29-7]
- Diabetes mellitus
  - Diabetes mellitus Type 1
    - 5-10% of diabetic population; more common in females over 40 but can occur at any age; onset usually abrupt following viral infection; requires life long insulin replacement
    - Possible causes: virus, autoimmune reaction and heredity
  - Diabetes mellitus: Type 2
    - 90% of the diabetic population, occurs at any age; slower onset
    - Heredity and obesity play role in cause; pancreas still making some insulin
    - Treatment: diet and exercise; then oral antidiabetic drugs; may need insulin during times of illness, increased stress, and trauma, but then may return to oral medications alone.
    - Diabetes mellitus: impaired glucose tolerance (IGT) (previously called "borderline diabetic"); usually overweight with mild hyperglycemia and insulin resistance
    - Diagnosis: fasting blood sugars of 110 mg/dl to 126 on two occasions
    - Treatment: diet modification and limits on carbohydrates and sugars
  - Deaths related to DM [corresponds to Box 29-1]
  - Gestational diabetes
    - Occurs during final trimester of pregnancy
    - Weight gain during pregnancy leading to insulin resistance; usually mild and controlled with diet; may be asymptomatic and found in prenatal screen; occasionally insulin is required.
    - Increases fetal and perinatal complications
    - Babies have higher birth weights, return to normal blood sugar post delivery, have increased risk of diabetes later in life.
Secondary diabetes
  • May result from trauma or disease to the pancreas, such as pancreatitis, pancreatectomy, or cystic fibrosis.
  • Possible causes hormonal (including Cushing’s disease), certain drugs (e.g. Dilantin, birth control pills, and steroids)

Manifestations of diabetes mellitus: [corresponds to Figure 29-8]
  • Polyuria, polydipsia, polyphagia are 3 most common symptoms
  • Pathophysiology of diabetes mellitus [corresponds to Figure 29-10]

Diagnosis:
  • Fasting blood sugar test (70-130 mg is normal)
  • Postprandial blood sugar 2 hours after regular meal (140-160 mg normal, but elderly often have mildly elevated blood level)
  • Glycohemoglobin – more accurate but longer test, no fasting necessary (4-7% is goal)
  • Glucose tolerance test – older test, blood and urine collected at intervals after concentrated glucose solution
  • Glucose monitoring (70-110 mg/dL is normal)[corresponds to Procedure 29-1]
  • Sugar and acetone test -renal threshold – glucose in urine, occurs when blood sugar is about 180 mg

Treatment:
  • Treat by balancing food, exercise, and medication (oral hypoglycemics, insulin)
  • Diet management is key; timing of diet and snacks important; may need to modify diet in times of stress, illness
  • Term: hyperosmolar hyperglycemic nonketotic coma (HHNC) – extreme hyperglycemia in client with Type 2 DM

Nursing care of client with diabetes:
  • Food balance: food exchange = foods with same number of carbohydrates, fat, or protein; can exchange within same group
  • Instruct the client on how to:
    ↑ Monitor their own blood glucose.
    ↑ Avoid skipping or delaying meals and snacks.
    ↑ Read nutrition labels.
  • Provide information about diet prescribed.
  • Teach clients and families
    ↑ To make healthy food choices, including nutritious fast foods and foods they like.
    ↑ Alcohol and oral hypoglycemic medication may cause hypoglycemic reactions
    ↑ Nicotine can damage nerves and walls of blood vessels.
    ↑ Exercise [corresponds to Box 29-2]
    ↑ Maintains blood sugar control
    ↑ Decreases stress
    ↑ Lowers heart rate and blood pressure.
    ↑ Should be avoided when ill. When ill, need:
- Regular intake of food and water
- Insulin or oral hypoglycemic medicine
- Blood glucose test q 4 hr
- Urine test for ketones
- Notify physician if vomiting or diarrhea persists > 6 hr or if unable to eat for > 24 hr.

• Teach client to:
  ↑ Inspect skin daily
  ↑ Prevent cuts, cracks and sores.
  ↑ Do proper care of feet
  ↑ See dentist twice a year for checkup and cleaning

• Medication
  ↑ Teach proper administration of insulin to clients on insulin
  ↑ Teach site rotation for subcutaneous injection [corresponds to Figure 29-12]
  ↑ Terms: onset, peak, duration [corresponds to Figure 29-13]
  ↑ US insulin strength U 100 (100 units/mL)
  o Fast-acting (e.g., regular) insulin (clear) given SQ or IV
  o Intermediate-acting insulin (cloudy) given SQ
  o Regular and intermediate often combined [corresponds to Procedure 29-2]
  o Long-acting insulin (e.g., protamine zinc) less commonly used
  o Sliding scale insulin [corresponds to Box 29-3]
  o Insulin pump – continuous infusion
    ↑ Oral medications not insulin, stimulate pancreas; different mechanisms of action and dosage regimens [corresponds to T 29-3]
      - Sulfonylureas (Diabinese, etc.)- may cause allergic reaction
      - Biguanides (Glucophage)
      - Thiazolidinediones (Avandia, Actos)
      - Alpha-glucosidase inhibitors (Precose)
      - Meglitinides (Prandin)
  o Short-term or acute complications of diabetes
    • Hypoglycemic reaction, insulin reaction, insulin shock – blood sugar < 60 mg/dL
    • Causes: too much insulin, skipping meal or snack, vigorous exercise; possible side effect of both insulin and oral hypoglycemic medication.
    • Reduce risk by frequent monitoring of blood glucose, sticking to dietary plan, consistent exercise
    • Manifestations:
      ↑ Pallor
      ↑ Weakness
      ↑ Clammy skin, cold sweats
      ↑ Trembling
↑ Headache, blurred or double vision
↑ Dizziness
↑ Irritable, nervous, hungry
↑ Tingling of lips and tips of fingers
↑ Confusion, slurred speech
↑ If untreated: seizures, unconsciousness

• Treatment:
  ↑ Watch for warning signals of a reaction; listen to client.
  ↑ Eat simple sugar immediately [corresponds to Box 29-4]
  ↑ After symptoms subside, eat complex carbohydrate e.g. a sandwich
  ↑ If client unconscious do not give oral fluids.

• Diabetic ketoacidosis
  ↑ High blood sugar leads to formation of ketones (waste product of breaking down fats for energy), result is diabetic ketoacidosis (diabetic coma).
  ↑ Most common in Type 1 diabetes.
  ↑ Manifestations:
    - Deep, rapid respirations (Kussmaul's respirations)
    - Flushed hot skin
    - Nausea and vomiting
    - Fruity breath due to acetone
  ↑ If untreated leads to diabetic coma and death.
  ↑ Risk reduced by monitoring blood sugar frequently and sliding scale insulin as needed.

• Hyperosmolar hyperglycemic nonketotic coma (HHNC)
  ↑ Seen most in Type 2 diabetics 50-70 years old
  ↑ Causes of HHNC
    - Pneumonia, heart attack or stroke
    - Therapeutic procedure like dialysis, central line insertion.
  ↑ Manifestations: hyperglycemia, altered sensorium, and minimal ketosis; history of polyuria, inadequate fluid intake; confusion; blood is viscous; fluid and electrolyte losses and imbalance
  ↑ If untreated, coma.
  ↑ Treatment:
    - Insulin to control severe hyperglycemia Intravenous hypotonic saline solution with added electrolytes
  ↑ Nursing care:
    - Monitor EKG and vital signs closely; observe for signs of hypoglycemia even if reading is not < 60-70 mg/dL.
    - Administer insulin as ordered.
    - Monitor blood sugar and prevent complications.

o Chronic complications of diabetes mellitus
  • (Can be delayed, lessened, or stopped by controlling blood sugar)
  • Heart and blood vessel complications:
    ↑ Heart attack, stroke
↑ Impaired circulation
- Paleness of lower extremities
- Reduced pedal pulses and poor capillary refill
- Possible loss of hair on dorsal side of foot
- Thickened toenails and brown spots noted on skin of legs.
• Renal complications:
  ↑ Damage and leakage in the glomeruli
  ↑ Waste product build-up
  ↑ Can lead to end-stage renal disease
• Diabetic neuropathy (nerve damage or disease)- burning, tingling, numbness in hands, feet and legs
• Dizziness, double vision, ringing or buzzing in the ears
• Impotence in males; decreased libido in men or women
• Incomplete bladder emptying
• Diabetic retinopathy - tissue damage and scarring of retina, may lead to blindness
• Periodontal disease
• Tissue breakdown and necrosis, especially of foot [corresponds to Box 29-5]

• Nursing care of clients with DM:
  • Assess for 3Ps: polyuria, polydipsia, polyphasia.
  • Inspect skin daily.
  • Check feet for circulation, wounds and reddened areas.
  • Prevent infections; protect from bumps, bruises, and trauma that could lead to gangrene; teach client not to sit with legs hanging down and not to cross legs.
  • Encourage exercise.
  • Monitor finger stick blood sugars as ordered.
  • Administer insulin or antidiabetic drug as ordered.
  • Teach client to manage this medication.
  • Monitor vital signs, especially BP.
  • Observe client’s tray and snacks (Type 1 especially); report any food not eaten, so calorie adjustments can be made.

Nursing Process Care Plan: Client with Diabetes Mellitus

Adrenal Gland Disorders
° Addison’s disease – insufficient corticosteroid secretion by adrenals
° Mostly women 30-50 years of age.
  ° Cause:
    • Possibly autoimmune - adrenal cortex attacks itself
    • Adrenalectomy
  ° Onset of Addison’s is slow; symptoms appear when 90% of gland has been destroyed.
  ° Manifestations:
    • Bronze skin color (especially hands, elbows, knees)
↑ Low BP, tachycardia; hypoglycemia, weakness, and fatigue; inability to stimulate liver gluconeogenesis; electrolyte imbalance; possible depression and psychosis.

- **Diagnosis:**
  - 24-hour urine test for ketosteroids and 17 hydroxycorticosteroids
  - MRI and CT scan to identify adrenal atrophy

- **Treatment of Addison's disease**
  - Lifelong replacement of glucocorticoids and mineralocorticoids
  - High sodium low potassium diet
  - Medication increase in high stress periods.

- **Addisonian crisis (Adrenal crisis)**
  - Life threatening; causes include major stressors, abrupt cessation of steroid medication
  - **Manifestations:**
    - Hypotension
    - Weakness
    - Rapid weak pulse
    - Fluid volume deficit and dehydration
    - Cardiac arrhythmias and arrest
    - Circulatory collapse and shock
  - **Treatment of Addisonian crisis:**
    - Intravenous fluids
    - Sodium replacement
    - Glucose, glucocorticoids, and mineralocorticoids
    - Cardiac support
    - Bed rest in a calm, quiet environment

- **Nursing care of client with Addison’s disease:**
  - Assess for dehydration, poor skin turgor, thirst, and dry skin; offer fluids frequently.
  - Monitor VS q 4 hr or more. Check lab results of sodium, potassium, and glucose levels; report changes to care provider.
  - Provide diet high in calories and sodium, but low in potassium. Offer frequent small meals. Reinforce dietary compliance.
  - Assist client with ADLs and encourage rest.
  - Teach client about disease, treatment, and compliance.
  - Encourage client to wear identifying bracelet or necklace in case of emergency.

° **Cushing’s disease - overproduction of cortisol by adrenals**
  - More common in women ages 30 -50.
  - **Causes:**
    - Adrenal tumor increasing secretion of cortisol
    - Pituitary tumor
    - Chronic steroid therapy
    - Ectopic release of ACTH from lung and pancreatic tumors
  - **Manifestations:**
    - Weight gain in the truncal area with thin arms and legs
- Buffalo hump below back of neck
- “Moon face” look due to fatty tissue deposits
- Muscle wasting, purple striae, easy bruising and thin skin
- Possible additional signs/symptoms:
  - Diabetes
  - Osteoporosis
  - Water and sodium retention, increased BP, edema.
  - Infection, delayed healing
  - Irritability and psychosis
  - Acne, hirsutism and amenorrhea in women.

Diagnosis:
- Blood test shows increased serum cortisol, mineralocorticoids, and androgen; low ACTH. Elevated sodium and glucose, low potassium.
- 24-hr urine test shows high cortisol levels.

Treatment:
- Medication
  - Mitotane or ketoconazole to block production of adrenal steroids (controls disorder, does not cure it)
  - Tapering of steroid medication if that is cause
- Radiation therapy if cause is a tumor
  - Reduces size of tumor
  - May destroy adrenal cortex, requiring lifelong replacement hormone
- Surgery (adrenalectomy) removes tumor, requires lifelong replacement hormone

Nursing care of clients with Cushing’s disease:
- Auscultate lung sounds for crackles; restrict fluids as ordered.
- Help client use assistive devices; protect from falls.
- Encourage rest periods.

Pheochromocytoma
- Benign tumor in adrenal medulla causes excessive amount of epinephrine and norepinephrine
- Manifestations – vary from mild to very severe:
  - Marked hypertension (200-300 systolic over 150 diastolic)
  - Pounding headache
  - Tachycardia, diaphoresis, flushing, and palpitations.
  - Myocardial infarction (MI), stroke, and death can result

Treatment:
- Adrenalectomy
- Postoperative focus on stabilizing blood pressure

Nursing care for clients with pheochromocytoma:
- Monitor BP every hour (more frequently if ordered).
- Administer antihypertensive medication as ordered.
- Observe closely for hypotension.

Nursing care (general) for clients with adrenal disorders:
Monitor fluid balance, VS (especially BP).
Measure I&O carefully.
Check level of consciousness and orientation q 2-4 hr.
Review lab test results for changes in sodium, potassium, glucose, and cortisol.
Provide support to client about changes in self-image.

Gonads (see Chapters 30 and 39)
Critical Thinking Care Map: Caring for a Client with a Stasis Ulcer