LESSON ASSIGNMENT

LESSON 2 Diseases and Disorders of the Endocrine System.

LESSON ASSIGNMENT Paragraphs 2-1 through 2-7.

LESSON OBJECTIVES After completing this lesson, you should be able to:

2-1. Identify the signs, symptoms, and treatment for the thyroid gland disorders hyperthyroidism and adult hypothyroidism.

2-2. Identify the signs, symptoms, and treatment for the adrenal gland disorders Addison's disease, Cushing's disease, Conn's syndrome, and pheochromocytoma.

2-3. Identify the signs, symptoms, and treatment for the anterior lobe adrenal gland disorders hypersecretion and hyposecretion.

2-4. Identify the signs, symptoms, and treatment for the parathyroid glands disorders hyperparathyroidism and hypoparathyroidism.

2-5. Define the Islands of Langerhans disorders of hypersecretion of insulin and hyposecretion of insulin.

SUGGESTION After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.
LESSON 2

DISEASES AND DISORDERS OF THE ENDOCRINE SYSTEM

2-1. INTRODUCTION

The function of the endocrine system is to help the nervous system regulate the processes of the body; for example, growth, metabolic rate, etc. Therefore, disease in any part of the endocrine system will cause problems in several body functions. This lesson examines some of the diseases and disorders of the endocrine system.

2-2. DISEASES OF THE THYROID GLAND

a. Hyperthyroidism (Graves Disease).

(1) Description. Hyperthyroidism is an imbalance in the body’s metabolism caused by excessive production of the thyroid hormone. Too much thyroxine is produced which leads to many changes in the body, a most noticeable change being an enlarged thyroid gland in the neck—a goiter. This condition occurs chiefly in the 30 to 40 age group. Only five percent of patients with this condition are under age 15.

(2) Signs and symptoms. Excessive production of the thyroid hormone causes changes in many of the body systems. Central nervous system changes include excitability or nervousness and a tremor in the hands. Cardiovascular system changes include tachycardia and a full, bounding pulse. Respiratory changes include labored breathing, and a higher incidence of spontaneous abortions is one of the changes in the reproductive system. Not all these changes always occur in a patient with hyperthyroidism. The most common body changes, characteristic of Graves’ disease, a type of upper thyroidism, and are listed below.

(a) Enlarged thyroid gland, commonly called a goiter.

(b) Heat intolerance and unusual sweating.

(c) Nervousness and weakness.

(d) Overactivity combined with irritability and fatigue.

(e) Unexplained weight loss, usually with increased appetite.

(f) Exophthalmos (protruding eyes), a fixed stare, and a lack of visual accommodation. (Protruding eyes are caused by the effects of accumulated intracellular material and fluids in the tissues behind the eye which force the eyeball outward. Sometimes the eyelids retract causing the patient to look as if he is staring.)
(g) These signs/symptoms can increase in intensity suddenly. This condition is called Thyroid storm. It is dangerous and can be fatal. Signs and symptoms can be accompanied by extreme irritability, hypertension, tachycardia, vomiting, and a temperature up to 106 F. Final stages include delirium followed by coma.

NOTE: A nodular (lumpy) goiter with no exophthalmos (protruding eyeball) indicates Plummers' disease. This condition is less dangerous than Graves' disease.

(3) Treatment.

(a) Primary treatment for hyperthyroidism. The two main types of treatment are antithyroid drugs and surgery. Method of treatment depends on the size of the goiter, the causes, the patient's age and whether or not pregnant, and how long before surgery could be performed (if surgery is one the patient's options). In the past, surgical removal of the goiter has been the most widely used method of treatment. Antithyroid drug therapy includes use of thyroid hormone antagonists such as propylthiouracil (PTU) and methimazole. Both drugs reduce the production of the thyroid hormone thyroxin. Another form of treatment is a single dose of I\textsubscript{131}, a radioactive element which destroys some of the thyroid gland's cells that normally produce thyroxin. The result is that thyroid hormone production decreases, and the thyroid gland decreases to its normal size. At its normal size, the gland produces only the normal amount of the hormone thyroxin.

(b) Thyroid storm treatment. Drug therapy is used. Other measures include such supportive treatment as nutrients, vitamins, giving fluid, and sedation, if necessary.

b. Adult Hypothyroidism (Myxedema).

(1) Description. Hypothyroidism is the reverse of hyperthyroidism. The thyroid gland produces too much thyroxin in hyperthyroidism. The condition hypothyroidism is caused when the thyroid gland produces too little thyroxin. Lack or complete absence of thyroid gland activity from birth causes cretinism. Cretinism is a dwarfed, mentally retarded state due to a failure of physical growth and mental development. Early detection and treatment of this condition can prevent abnormal physical development and mental retardation. Children under one year can be treated.

(2) Early signs/symptoms.

(a) Fatigue.

(b) Forgetfulness.

(c) Sensitivity to cold.
(d) Unexplained weight gain.

(e) Constipation.

(3) **Later signs/symptoms.**

(a) Decreasing mental stability.

(b) Dry, flaky, inelastic skin.

(c) Puffy face, hands, feet.

(d) Hoarseness.

(e) Edema around the eyes.

(f) Upper eyelids droop.

(g) Dry, sparse hair.

(h) Thick, brittle nails.

(4) **Still later signs/symptoms.**

(a) Gradual or sudden coma.

(b) Progressive stupor.

(c) Hypoglycemia.

(d) Hypotension.

(5) **Treatment.** Treat by giving thyroid extract or synthetic thyroid preparation usually by mouth. The drugs of choice are Synthroid and Levothroid.

(6) **Diagnostic tests.**

(a) Thyroxin test (T₄). This is a blood test which measures the amount of thyroxin in the blood. The level of thyroxin in the blood will be lower in hypothyroidism and higher in hyperthyroidism.
(b) **Radioactive iodine uptake test.** This test measures the amount of radioactive iodine (I\textsubscript{131}) which the thyroid gland metabolizes. The patient is given radioactive iodine orally or intravenously. Then, a scintillation camera scans the thyroid gland and produces a pattern which shows the size of the gland. If the patient is given radioactive iodine orally, the test will be done twenty-four hours later. Iodine administered intravenously allows the test to be performed thirty minutes later. There are no fluid or food restrictions for a patient having this test. Several factors affect the test results causing the results to be invalid. These factors include:

1. The patient has been taking drugs and estrogens containing iodine in the last thirty days (adrenocorticosteroids, sulfonamide, contraceptives).
2. The patient has had x-ray studies using iodine containing media.
3. The patient has eaten a lot of seafood recently.

(c) **Thyrotropin test (TSH).** This test measure the thyroid gland response to pituitary hormone stimulus.

2-3. **DISEASES OF THE ADRENAL GLANDS**

a. **Addison's Disease (Adrenal Hypofunction).**

   (1) **Description.** Addison's disease is a condition resulting from adrenocortical insufficiency; that is, the adrenal gland is not functioning enough. The adrenal gland has either degenerated or stopped functioning.

   (2) **Signs and symptoms.** Typical signs and symptoms include:

      (a) Weakness, fatigue, weight loss.
      (b) Swollen lymph nodes.
      (c) Conspicuous bronze coloration of light-colored skin.
      (d) Dehydration, hypotension, small heart size.
      (e) Anorexia, nausea, vomiting, and diarrhea.
      (f) Nervous and mental irritability.
      (g) Faintness after missing meals.
      (h) Decreased tolerance to cold and hypometabolism (lowered metabolism rate).
(i) Scant to absent armpit and pubic hair (especially in women).

(j) Absence of sweating.

(k) Severe dental caries.

(3) Treatment. Give steroid medications such as cortisone or hydrocortisone.

b. Cushing's Disease.

(1) Description. Also called Cushing's syndrome, this is a group of abnormalities caused by too high a level of adrenocortical hormones.

(2) Signs and symptoms. This condition causes changes in many of the body's systems. Common signs and symptoms are:

(a) Obesity with a round face ("moon face").

(b) Impotence in the male.

(c) Weakness.

(d) Backache.

(e) Hypertension.

(f) Excessive hair growth.

(g) Purple bands (striae), especially around the thighs, breasts, and abdomen.

(h) Dental caries (tooth decay).

(3) Treatment. There are three possibilities: irradiation; drug therapy; or surgery. The type of treatment selected depends on the condition of the individual patient.

c. Conn's Syndrome (Hyperaldosteronism).

(1) Description. This condition, the adrenal cortex secretes too much mineral-ocorticoid aldosterone (a steroid in the adrenal cortex that controls salt metabolism). The result is that the body reabsorbs too much sodium and water, and the kidneys excrete too much potassium.
(2) **Signs and symptoms.** Included are the following:

(a) Decline in potassium level in the blood (hypokalemia) which results in muscle weakness.

(b) Concentration of urine by the kidneys is difficult (polyuria).

(c) Elevation in blood sodium (hypernatremia) which results in excessive thirst (polydipsio) and high blood pressure (hypertension).

(3) **Treatment.** One possible treatment is unilateral adrenalectomy (removal of the adrenal gland). Another possible treatment is administration of spironolactone (a potassium-sparing diuretic) and sodium restriction; this treatment has been successful in controlling the condition without surgery.

d. **Pheochromocytoma.**

(1) **Description.** A pheochromocytoma is a tumor of the chromaffin cells which is usually found in the adrenal medulla.

(2) **Signs and symptoms.** Included are:

(a) Hypertension.

(b) Tachycardia.

(c) Tremor.

(d) Excessive perspiration.

(e) Hyperglycemia.

(f) Polyuria (passage of abnormally large quantities of urine).

(g) Gastrointestinal symptoms such as abdominal pain, nausea, vomiting.

(h) Abnormal sensation (burning, tingling, or numbness) in the extremities, possibly.

(3) **Treatment.** Usually, the tumor is removed surgically.
2-4. DISEASES OF THE PITUITARY GLAND--ANTERIOR LOBE

a. Hypersecretion (Hyperpituitarism, Acromegaly, Gigantism).

(1) Description. The pituitary gland secretes too much of the growth hormone. If this occurs in children, the result is gigantism (an abnormal skeletal development). Excessive production of the growth hormone when an individual is an adult causes acromegaly (head, face, hands, feet, and internal organs get progressively larger). In gigantism, the people are generally large but usually very weak. In acromegaly, the bones of the face, hands, and feet widen. The jaw protrudes, and the forehead bones bulge.

(2) Signs and symptoms. The condition acromegaly develops slowly and produces a variety of symptoms including excessive sweating, oily skin, a high metabolic rate, and heavy hair growth in places where the hair growth is usually light; for example, on the female face. In contrast, gigantism seems to develop rapidly. As gigantism progresses, the pituitary tumor which causes the condition gets bigger causing disturbances in other systems of the body. Treatment includes irradiation or surgical removal of the tumor.

b. Hyposecretion.

(1) Description. The condition occurs when not enough hormones are secreted by the anterior lobe of the pituitary gland. The result is metabolic dysfunction, sexual immaturity, and growth retardation when the problem takes place in childhood. In an adult, insufficient amounts of these hormones results in a condition called Simmond's disease. Signs and symptoms include emaciation (extreme thinness), asthenia (severe weakness or loss of strength), lowered metabolic rate, low temperature, and low blood pressure. The cause of this deficiency in the production of hormones is usually trauma, tumor, or hemorrhage.

(2) Treatment. Treatment is either surgical removal or x-ray irradiation if there is a tumor. Drug therapy to replace needed hormones is very effective. Cortisol, thyroxin, and androgen or cyclic estrogen may be prescribed.

2-5. DISEASES OF THE PARATHYROID GLANDS

a. Hyperparathyroidism. One or more of the parathyroid glands enlarges. Too much parathyroid hormone is secreted, and the serum calcium level becomes too high. There is a change in the function of cells of the bone, renal tubules, and gastrointestinal mucosa. The withdrawal of calcium from bones (osteoporosis) leads to hypercalcemia (abnormally high concentration of calcium in the blood) and kidney stones. Other signs and symptoms include muscular weakness, gastrointestinal symptoms such as anorexia, nausea, vomiting, and abdominal pains. Treatment depends on the diagnosis of the cause of the condition. Surgical removal of the parathyroid tissue is often the treatment.
b. **Hypoparathyroidism.** This condition is the result of insufficient amounts of the parathyroid hormone (PTH) being produced by the parathyroid glands. The cause can be disease, injury, or a malfunction of these glands which was present at birth. This hormonal insufficiency leads to lower than normal blood concentration of calcium resulting in muscle spasms and convulsions. There can be dermatologic, ophthalmologic (cataracts), psychiatric, and dental symptoms of this condition. Treatment is the replacement of calcium in the body.

2-6. **ISLANDS OF LANGERHANS (IN THE PANCREAS).**

The islands or islets of Langerhans consist of clusters of cells that make up the endocrine portion of the pancreas. These cells produce hormones. These cells can be classified as A cells, B cells, D cells, and F cells depending on the hormone produced by each type of cell. The most numerous cells are B cells which produce insulin. Two types of disorders result if the B cells do not produce the necessary quantity or quality of insulin: hyposecretion of insulin and hypersecretion of insulin.

a. **Hyposecretion of Insulin.** Too little insulin is secreted. There is sugar in the urine, and the level of blood sugar is abnormally high. These are characteristics of diabetes mellitus, a disease discussed in lesson 3.

b. **Hypersecretion of Insulin.** Too much insulin is secreted by the cells in the islands of Langerhans. The result is hypoglycemia which is abnormally low levels of blood sugar. The signs and symptoms of this condition include sweating, hunger, weakness, and lightheadedness. The symptoms often disappear after the patient eats a snack.

2-7. **CLOSING**

These diseases and disorders may not be life-threatening, but they can be painful and a detriment to the soldier's completion of duty. Management of patients with these health problems can have a great impact on the Army's ability to complete the mission.

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Continue with Exercises

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EXERCISES, LESSON 2

INSTRUCTIONS. The following exercises are to be answered by writing the answer in the space provided. After you have completed all the exercises, turn to the solution at the end of the exercises and check your answers.

1. What is hyperthyroidism? Hyperthyroidism is __________________________
   __________________________ ________________________________________

2. List three signs/symptoms of hyper-thyroidism.
   a. _____________________________________________________________
   b. _______________ ______________________________________________
   c. _______________ ______________________________________________

3. Myxedema, also referred to as ________________________, is caused when the thyroid gland produces ________________________________.

4. List four early signs/symptoms of myxedema.
   a. __________________ ___________________________________________
   b. __________________ ___________________________________________
   c. __________________ ___________________________________________
   d. __________________ ___________________________________________

5. Addison's disease results when the adrenal gland does not produce enough __________________________ hormones.
6. Typical signs/symptoms of adrenal hypofunction include: (list three).
   a. ________________________________________________________________
   b. ________________________________________________________________
   c. ________________________________________________________________

7. List three signs/symptoms of Cushing's syndrome.
   a. ________________________________________________________________
   b. ________________________________________________________________
   c. ________________________________________________________________

8. In Conn's syndrome, the adrenal cortex secretes too much mineralocorticoid with the result that the body reabsorbs too much _________________________ and _________________________, and the kidneys excrete too much.

9. A ______________________ is a tumor which occurs in the chromaffin cells. This tumor is usually found in the adrenal medulla.

10. Gigantism can be caused when the ___________________________ gland secretes too much of the growth hormone.

11. _______________________________ can occur when the anterior lobe of the pituitary gland does not secrete enough hormones.

12. _______________________________ is a condition caused by not enough parathyroid hormone being produced by the parathyroid glands.
13. Sometimes too much parathyroid hormone is secreted, and one or more of the parathyroid glands enlarges. The name of this condition is _________________.

14. The islands of Langerhans are clusters of cells making up the endocrine part of the ________________________. Insulin is produced by the ________ cells in the islands of Langerhans.

Check Your Answers on Next Page
SOLUTIONS TO EXERCISES, LESSON 2

1. An imbalance in the body’s metabolism caused by excessive production of the thyroid hormone.  (para 2-2a(1))

2. You are correct if you listed any three of the following:

   - Enlarged thyroid gland.
   - Heat intolerance/unusual sweating.
   - Nervousness/weakness.
   - Overactivity plus irritability/fatigue.
   - Unexplained weight loss with increased appetite.
   - Exophthalmos, fixed stare, decreased visual accommodation.  (para 2-2a(2))

3. Adult hypothyroidism, too little thyroxin.  (para 2-2b(1))

4. You are correct if you listed any four of the following:

   - Fatigue.
   - Forgetfulness.
   - Sensitivity to cold.
   - Unexplained weight gain.
   - Constipation.  (para 2-2b(2)(a))

5. Adrenocortical.  (para 2-3a)

6. You are correct if you listed any three of the following:

   - Weakness, fatigue, weight loss.
   - Swollen lymph nodes.
   - Conspicuous bronze coloration of light skin.
   - Dehydration, hypotension, small heart size.
   - Anorexia, nausea, vomiting, diarrhea.
   - Nervous and mental irritability.
   - Faintness after missing meals.
   - Decreased tolerance to cold.
   - Scant to absent armpit/pubic hair.
   - Absence of sweating.
   - Sever dental caries (cavities).  (para 2-3a(2))
7. You are correct if you listed any three of the following:

- Obesity with a round face.
- Impotence in the male.
- Weakness.
- Backache.
- Hypertension.
- Excessive hair growth.
- Purple bands.
- Tooth decay. (para 2-3b(2))

8. Sodium
   Water
   Potassium. (para 2-3c(1))

9. Pheochromocytoma. (para 2-3d(1))

10. Pituitary. (para 2-4a(1))

11. Growth retardation. (para 2-4b(1))

12. Hypoparathyroidism. (para 2-5b)

13. Hyperparathyroidism. (para 2-5a)

   B. (para 2-6)

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