chapter 25

Thyroid and Antithyroid Drugs

Objectives

AFTER STUDYING THIS CHAPTER, THE STUDENT WILL BE ABLE TO:

1. Describe physiologic effects of thyroid hormone.
2. Identify subclinical, symptomatic, and severe effects of inadequate or excessive thyroid hormone.
3. Describe characteristics, uses, and effects of thyroid drugs.
4. Describe characteristics, uses, and effects of antithyroid drugs.
5. Discuss the influence of thyroid and antithyroid drugs on the metabolism of other drugs.
6. Teach clients self-care activities related to the use of thyroid and antithyroid drugs.

Critical Thinking Scenario

Mary Sanchez, 55 years of age, is diagnosed with chronic (Hashimoto's) thyroiditis and is to begin treatment with levothyroxine (Synthroid) 0.1 mg daily. You are the nurse in the clinic and responsible for teaching Ms. Sanchez about her hypothyroidism and thyroid replacement therapy.

Reflect on:

- Signs and symptoms of hypothyroidism and its impact on functional abilities.
- Priority information that should be given to Ms. Sanchez during the brief (10-minute) time allotted.
- How you will need to individualize teaching if Ms. Sanchez's ability to speak and read English is limited.
- Necessary follow-up for Ms. Sanchez's hypothyroidism and drug management.

OVERVIEW

The thyroid gland produces three hormones: thyroxine, triiodothyronine, and calcitonin. Thyroxine contains four atoms of iodine and is also called T_4. Triiodothyronine contains three atoms of iodine and is called T_3. Compared with thyroxine, triiodothyronine is more potent and has a more rapid onset but shorter duration of action. Despite these minor differences, the two hormones produce the same physiologic effects and have the same actions and uses. Calcitonin functions in calcium metabolism and is discussed in Chapter 26.

Production of thyroxine and triiodothyronine depends on the presence of iodine and tyrosine in the thyroid gland. Plasma iodide is derived from dietary sources and from the metabolic breakdown of thyroid hormone, which allows some iodine to be reused. The thyroid gland extracts iodide from the circulating blood, concentrates it, and secretes enzymes that change the chemically inactive iodide to free iodine atoms. Tyrosine is an amino acid derived from dietary protein. It forms the basic structure of thyroglobulin. In a series of chemical reactions, iodine atoms become attached to tyrosine to form the thyroid hormones T_3 and T_4. Once formed, the hormones are stored within the chemically inactive thyroglobulin molecule.

Thyroid hormones are released into the circulation when the thyroid gland is stimulated by thyroid-stimulating hormone (thyrotropin or TSH) from the anterior pituitary gland. Because the thyroglobulin molecule is too large to cross cell membranes, proteolytic enzymes break down the molecule so the active hormones can be released. After their release from thyroglobulin, the hormones become largely bound to plasma proteins. Only the small amounts left unbound are biologically active. The bound thyroid hormones are released to tissue cells very slowly. Once in the cells, the hormones combine with intracellular proteins so they are again stored. They are released slowly within the cell and used over a period of days or weeks. Once used by the cells, the thyroid hormones release the iodine atoms. Most of the iodine is reabsorbed and used to produce new thyroid hormones; the remainder is excreted in the urine.

Thyroid hormones control the rate of cellular metabolism and thereby influence the functioning of virtually every cell