in the body. The heart, skeletal muscle, liver, and kidneys are especially responsive to the stimulating effects of thyroid hormones. The brain, spleen, and gonads are less responsive. Thyroid hormones are required for normal growth and development and are considered especially critical for brain and skeletal development and maturation. These hormones are thought to act mainly by controlling intracellular protein synthesis. Some specific physiologic effects include:

- Increased rate of cellular metabolism and oxygen consumption with a resultant increase in heat production
- Increased heart rate, force of contraction, and cardiac output (increased cardiac workload)
- Increased carbohydrate metabolism
- Increased fat metabolism, including increased lipolytic effects of other hormones and metabolism of cholesterol to bile acids
- Inhibition of pituitary secretion of TSH

THYROID DISORDERS

Thyroid disorders requiring drug therapy are goiter, hypothyroidism, and hyperthyroidism. Hypothyroidism and hyperthyroidism produce opposing effects on body tissues, depending on the levels of circulating thyroid hormone. Specific effects and clinical manifestations are listed in Table 25–1.

Simple Goiter

Simple goiter is an enlargement of the thyroid gland resulting from iodine deficiency. Inadequate iodine decreases thyroid hormone production. To compensate, the anterior pituitary gland secretes more TSH, which causes the thyroid to enlarge and produce more hormone. If the enlarged gland secretes enough hormone, thyroid function is normal and the main consequences of the goiter are disfigurement, psychological distress, dyspnea, and dysphagia. If the gland cannot secrete enough hormone despite enlargement, hypothyroidism results. Simple or endemic goiter is a common condition in some geographic areas. It is uncommon in the United States, largely because of the widespread use of iodized table salt.

Treatment of simple goiter involves giving iodine preparations and thyroid hormones to prevent further enlargement and promote regression in gland size. Large goiters may require surgical excision.

Hypothyroidism

Primary hypothyroidism occurs when disease or destruction of thyroid gland tissue causes inadequate production of thyroid hormones. Common causes of primary hypothyroidism include chronic (Hashimoto's) thyroiditis, an autoimmune disorder, and treatment of hyperthyroidism with antithyroid drugs, radiation therapy, or surgery. Other causes include previous radiation to the thyroid area of the neck and treatment with amiodarone, lithium, or iodine. Secondary hypothyroidism occurs when there is decreased TSH from the anterior pituitary gland.

Congenital hypothyroidism (cretinism) occurs when a child is born without a thyroid gland or with a poorly functioning gland. Cretinism is uncommon in the United States but may occur with a lack of iodine in the mother's diet. Symptoms are rarely present at birth but develop gradually during infancy and early childhood and include poor growth and development, lethargy and inactivity, feeding problems, slow pulse, subnormal temperature, and constipation. If the disorder is untreated until the child is several months old, permanent mental retardation is likely to result.

Adult hypothyroidism (myxedema) may be subclinical or clinical and occurs much more often in women than in men. Subclinical hypothyroidism, which is the most common thyroid disorder, involves a mildly elevated serum TSH and normal serum thyroxine levels. It is usually asymptomatic. Clinical hypothyroidism produces variable signs and symptoms, depending on the amount of circulating thyroid hormone. Initially, manifestations are mild and vague. They usually increase in incidence and severity over time as the thyroid gland gradually atrophies and functioning glandular tissue is replaced by nonfunctioning fibrous connective tissue (see Table 25–1).

Myxedema coma is severe, life-threatening hypothyroidism characterized by coma, hypothermia, cardiovascular collapse, hypoventilation, and severe metabolic disorders such as hyponatremia, hypoglycemia, and lactic acidosis. Predisposing factors include exposure to cold, infection, trauma, respiratory disease, and administration of central nervous system (CNS) depressant drugs (eg, anesthetics, analgesics, sedatives). A person with severe hypothyroidism cannot metabolize and excrete the drugs.

Treatment

Regardless of the cause of hypothyroidism and the age at which it occurs, the specific treatment is replacement of thyroid hormone from an exogenous source. Synthetic levothyroxine is the drug of choice. In patients with subclinical hypothyroidism, levothryroxine should be given if the serum TSH level is higher than 10 microunits/L. There is some difference of opinion about treatment for TSH values between 5 and 10 microunits/L. Two arguments for treatment of subclinical hypothyroidism are the high rate of progression to symptomatic hypothyroidism and improvement of cholesterol metabolism (eg, low-density lipoprotein [LDL] or "bad" cholesterol is reduced).

In patients with symptomatic hypothyroidism, levothyroxine therapy is definitely indicated. In addition to improvement of metabolism, treatment may also improve cardiac function, energy level, mood, muscle function, and fertility. In myxedema coma, levothyroxine or liothyronine is given intravenously, along with interventions to relieve precipitating factors and to support vital functions until the thyroid hormone becomes effective, often within 24 hours.