tions of hyperthyroidism are listed in Table 25–1. These effects vary, depending on the amount of circulating thyroid hormone, and they usually increase in incidence and severity with time if hyperthyroidism is not treated.

Subclinical hyperthyroidism is defined as a reduced TSH (below 0.1 microunit/L) and normal thyroxine and triiodothyronine levels. The most common cause is excess thyroid hormone therapy. Subclinical hyperthyroidism is a risk factor for osteoporosis in postmenopausal women who do not take estrogen replacement therapy, because it leads to reduced bone mineral density. It also greatly increases the risk of atrial fibrillation in clients over 60 years of age.

Thyroid storm or thyrotoxic crisis is a rare but severe complication characterized by extreme symptoms of hyperthyroidism, such as severe tachycardia, fever, dehydration, heart failure, and coma. It is most likely to occur in clients with hyperthyroidism that has been inadequately treated, especially when stressful situations occur (eg, trauma, infection, surgery, emotional upsets).

Treatment

Treatment of hyperthyroidism depends on the cause. If the cause is an adenoma or multinodular goiter, surgery or radioactive iodine therapy is recommended, especially in older clients. If the cause is excessive levothyroxine dosage for hypothyroidism, the dose should be reduced. If the cause is Graves' disease, treatment may involve antithyroid drugs, radioactive iodine, surgery, or a combination of these methods. The drugs act by decreasing production or release of thyroid hormones. Radioactive iodine emits rays that destroy thyroid gland tissue. Subtotal thyroidectomy involves surgical excision of thyroid tissue. All these methods reduce the amount of thyroid hormones circulating in the bloodstream.

The antithyroid drugs include the thioamide derivatives (propylthiouracil and methimazole) and iodine preparations. The thioamide drugs inhibit synthesis of thyroid hormone, are inexpensive and relatively safe, and they do not damage the thyroid gland. These drugs may be used as the primary treatment (for which they may be given 6 months to 2 years) or to decrease blood levels of thyroid hormone before radioactive iodine therapy or surgery.

Radioactive iodine is a frequently used treatment. It is safe, effective, inexpensive, and convenient. One disadvantage is hypothyroidism, which usually develops within a few months and requires lifelong thyroid hormone replacement therapy. Another disadvantage is the delay in therapeutic benefits. Results may not be apparent for 3 months or longer, during which time severe hyperthyroidism must be brought under control with one of the thioamide antithyroid drugs. Other iodine preparations are not used in long-term treatment of hyperthyroidism. They are indicated when a rapid clinical response is needed, as in thyroid storm and acute hyperthyroidism, or to prepare a hyperthyroid person for thyroidectomy. A thioamide drug is given to produce a euthyroid state, and an iodine preparation is given to reduce the size and vascularity of the thyroid gland to reduce the risk of excessive bleeding.

Iodine preparations inhibit the release of thyroid hormones and cause them to be stored within the gland. They reduce blood levels of thyroid hormones more quickly than thioamide drugs or radioactive iodine. Maximal effects are reached in approximately 10 to 15 days of continuous therapy, and this is probably the primary advantage. Disadvantages, however, include the following:

- They may produce goiter, hyperthyroidism, or both.
- They cannot be used alone. Therapeutic benefits are temporary, and symptoms of hyperthyroidism may reappear and even be intensified if other treatment methods are not also used.
- Radioactive iodine cannot be used effectively for a prolonged period in a client who has received iodine preparations. Even if the iodine preparation is discontinued, the thyroid gland is saturated with iodine and does not attract enough radioactive iodine for treatment to be effective. Also, if radioactive iodine is given later, acute hyperthyroidism is likely to result because the radioactive iodine causes the stored hormones to be released into the circulation.
- Although giving a thioamide drug followed by an iodine preparation is standard preparation for thyroidectomy, the opposite sequence of administration is unsafe. If the iodine preparation is given first and followed by propylthiouracil or methimazole, the client is likely to experience acute hyperthyroidism because the thioamide causes release of the stored thyroid hormones.

Subtotal thyroidectomy is effective in relieving hyperthyroidism but also has several disadvantages. First, preparation for surgery requires several weeks of drug therapy. Second, there are risks involved in anesthesia and surgery and potential postoperative complications. Third, there is a high risk of eventual hypothyroidism. For these reasons, surgery is usually used for clients with large goiters or contraindications to other treatments.

Propranolol is used as an adjunctive drug in the treatment of hyperthyroidism. It relieves tachycardia, cardiac palpitations, excessive sweating, and other symptoms. Propranolol is especially helpful during the several weeks required for therapeutic results from antithyroid drugs or from radioactive iodine administration.

INDIVIDUAL DRUGS

The drugs are described in the following section; dosages are listed in Drugs at a Glance: Drugs for Hypothyroidism and Hyperthyroidism.

Thyroid Agents (Drugs Used in Hypothyroidism)

Levothyroxine (Synthroid, Levothroid), a synthetic preparation of thyroxine (T_4), is the drug of choice for long-term