**PROTOTYPE DRUG | Levothyroxine (Synthroid) | Thyroid Hormone**

**ACTIONS AND USES**
Levothyroxine, a synthetic form of thyroid hormone (T₄), is a drug of choice for replacement therapy in clients with low thyroid function. Actions are those of thyroid hormone, and include loss of weight, improved tolerance to environmental temperature, increased activity, and increased pulse rate. Doses are highly individualized. Therapy may take 3 weeks or longer before T₄ levels stabilize; doses may require periodic adjustments for several months. Serum TSH levels are monitored to determine whether the client is receiving sufficient levothyroxine—high TSH levels usually indicate that the dosage of T₄ needs to be increased.

**ADMINISTRATION ALERTS**
- Administer medication at the same time every day, preferably in the morning to decrease incidence of drug-related insomnia.
- Pregnancy category A.

**PHARMACOKINETICS**
Onset: Unknown
Peak: 3–4 wk
Half-life: 6–7 days
Duration: 1–3 wk

**ADVERSE EFFECTS**
The difference between a therapeutic and a toxic dose of levothyroxine is narrow, and care must be taken to avoid overtreatment. Adverse effects are those of hyperthyroidism and include palpitations, dysrhythmias, anxiety, insomnia, weight loss, and heat intolerance. Menstrual irregularities may occur in females, and long-term use of levothyroxine has been associated with osteoporosis in women.

**Contraindications:** This drug is contraindicated in clients with known or suspected adrenal insufficiency, and in clients hypersensitive to the drug.

**INTERACTIONS**
Drug–Drug: Cholestyramine and colestipol decrease the absorption of levothyroxine. Concurrent administration of epinephrine and norepinephrine increases the risk of cardiac insufficiency. Use with oral anticoagulants may potentiate hypoprothrombinemia.

Lab Tests: Unknown.
Herbal/Food: Lemon balm may interfere with thyroid hormone action.

**Treatment of Overdose:** Overdose can cause serious thyrotoxicosis, which may not present until several days after the overdose. Treatment is symptomatic, usually targeted at preventing cardiac toxicity with beta-adrenergic antagonists such as propranolol.

**See the Companion Website for a Nursing Process Focus specific to this drug.**

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**NURSING PROCESS FOCUS Clients Receiving Thyroid Hormone Replacement**

**Assessment**
Prior to administration:
- Obtain a complete health history including weight, allergies, drug history, and possible drug interactions.
- Obtain a complete physical examination.
- Assess for the presence and history of symptoms of hypothyroidism.
- Obtain ECG and laboratory studies including T₄, T₃, and serum TSH levels.

**Potential Nursing Diagnoses**
- Activity Intolerance, related to disease process
- Fatigue, related to impaired metabolic status
- Knowledge, Deficient, related to drug therapy
- Health Maintenance, Ineffective, related to side effects of drug

**Planning: Client Goals and Expected Outcomes**
The client will:
- Exhibit normal thyroid hormone levels.
- Report a decrease in hypothyroid symptoms.
- Experience no significant adverse effects from drug therapy.
- Demonstrate an understanding of the drug’s action by accurately describing drug side effects and precautions.

**Implementation**

**Interventions and (Rationales)**
- Monitor vital signs. (Changes in metabolic rate are manifested as changes in blood pressure, pulse, and body temperature.)
- Monitor for decreasing symptoms related to hypothyroidism such as fatigue, constipation, cold intolerance, lethargy, depression, and menstrual irregularities. (Decreasing symptoms demonstrate that drug is achieving therapeutic affect.)
- Monitor for symptoms related to hyperthyroidism such as nervousness, insomnia, tachycardia, dysrhythmias, heat intolerance, chest pain, and diarrhea. (Symptoms of hyperthyroidism indicate the drug is at a toxic level.)

**Client Education/Discharge Planning**
- Instruct client to report dizziness, palpitations, and intolerance to temperature changes.
- Instruct client about the signs of hypothyroidism and to report symptoms.
- Instruct client about the signs of hyperthyroidism and to report symptoms.

(Continued)

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**See the Companion Website for a Nursing Process Focus specific to this drug.**
Do not take other prescribed drugs, OTC medications, herbal therapies, or dietary supplements without notifying your healthcare provider.

Keep all scheduled appointments and laboratory visits for testing.

ANTITHYROID AGENTS

Medications are often used to treat the cause of hyperthyroidism or to relieve its distressing symptoms. The goal of antithyroid therapy is to lower the activity of the thyroid gland.

43.7 Pharmacotherapy of Hyperthyroidism

Hypersecretion of thyroid hormone results in symptoms that are the opposite of those caused by hypothyroidism: increased body metabolism, tachycardia, weight loss, elevated body temperature, and anxiety. The most common type of hyperthyroidism is called Graves' disease. Considered an autoimmune disease in which the body develops antibodies against its own thyroid gland, Graves' disease is four to eight times more common in women, and most often occurs between the ages of 30 and 40. Other causes of hyperthyroidism are adenomas of the thyroid, pituitary tumors, and pregnancy. If the cause of the hypersecretion is found to be a tumor, or if the disease cannot be controlled through pharmacotherapy, surgical removal of the thyroid gland is indicated.

The two primary drugs for hyperthyroidism, propylthiouracil (PTU) and methimazole (Tapazole), are called thioamides. These agents act by inhibiting the incorporation of iodine atoms into $T_3$ and $T_4$. Methimazole has a much longer half-life that offers the advantage of less frequent dosing, although side effects can be more severe. Both thioamides are pregnancy category D agents, but methimazole crosses the placenta more readily than propylthiouracil and is contraindicated in pregnant clients.

A third antithyroid drug, sodium iodide-131 (Iodotope) is a radioactive isotope that destroys overactive thyroid glands with ionizing radiation. Shortly after oral administration, I-131 accumulates in the thyroid gland, where it destroys follicular cells. The goal of pharmacotherapy with I-131 is to destroy just enough of the thyroid gland so that levels of thyroid function return to normal. Full benefits may take several months. Although most clients require only a single dose, others need multiple treatments. Small diagnostic doses of