The Development and Treatment of Hypothyroidism

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Program Overview:

To provide nurses and pharmacists with an understanding of the development and treatment of hypothyroidism.

OBJECTIVES:

After completing this program, participants will be able to:

- Explain basic thyroid structure and function
- Outline the risks and causes for the development of hypothyroidism
- Describe how hypothyroidism develops and what constitutes a diagnosis of the condition
- Explain the risks and benefits of medications for thyroid disease
- Describe the potential side effects and considerations of prescribing medications for hyperthyroidism
Introduction
Hypothyroidism is a type of endocrine disorder that has the ability to affect almost every system in the body. Hypothyroidism occurs as a result of the release of too few thyroid hormones, whether through inaction of the thyroid gland or failure of the brain to respond to the body's needs. Because thyroid hormones are important for so many body systems, hypothyroidism may be difficult to isolate due to varying symptoms and their degree of severity. Once a diagnosis is made, however, hypothyroidism can be effectively treated through several choices of hormone replacement, providing relief for those diagnosed with this condition.

Hypothyroidism Development
The Thyroid Gland
The thyroid gland is found on the front of the neck, approximately halfway between the chin and the clavicle, or at the level of the Adam's apple. It contains two lobes and has an appearance similar to that of a butterfly. Its structure covers the trachea as it divides into the right and left lobes, connected by an isthmus. The thyroid can be felt by palpating the neck, and an enlarged thyroid or one that is misshapen may be discovered upon manual examination. The thyroid is supplied with blood by certain vessels in the neck known as the thyroid arteries. It is surrounded by the superior and inferior thyroid artery and thyroid vein, as well as the carotid artery and the jugular vein. The gland is closely aligned with the cranial nerves that affect the voice as well as the parathyroid glands, which control the body's use of calcium.

The thyroid gland uses iodine to create thyroid hormone, and thus this element is essential to maintain proper thyroid function and to avoid hormone imbalance. Iodine is a type of trace element found throughout the world, typically in major oceans or in the soil. Iodine deficiency is a prominent public health problem in many parts of the world, and approximately 30 percent of the global population has insufficient iodine intake, according to the World Health Organization. Low levels of iodine are responsible for birth defects, mental retardation and developmental disabilities, goiter, and hypothyroidism.

For much of the developed world, hypothyroidism and goiter is controlled through iodizing certain types of food, namely salt. Iodine deficiency develops when iodine is removed from the soil through farming practices and erosion, causing deficits in the crops that grow there. When people eat food that has less iodine, overall iodine intake remains low, particularly in those areas where grains and cereals created from the iodine-leached soil make up a significant portion of the diet. Consistently low levels of iodine in the body cause the thyroid to produce lower levels of thyroid hormone, thereby creating hypothyroidism and causing an enlargement of the thyroid gland, known as a goiter. Continued low levels among the general population or diminished thyroid levels among pregnant women or children eventually cause damage to the brain or cretinism, a condition that produces mental retardation, muscle spasms, and mutism. Myxedema is another state that may occur as a result of severe, untreated hypothyroidism. Myxedema is manifested when mucopolysaccharides accumulate in the interstitial and subcutaneous tissues, causing skin thickening and swelling.
Risk Factors for Hypothyroidism
Hypothyroidism results because of too little thyroid hormones circulating in the bloodstream. This naturally affects metabolic processes throughout the body, causing a variety of symptoms for those affected. The risk of developing the condition may be higher among some groups of people.

Those who already suffer from some form of an autoimmune disease may be at higher risk of developing hypothyroidism. Diagnosed autoimmune diseases may impact the body’s hormone regulation and could increase the risk of developing autoimmune hypothyroidism. Some conditions may pose a higher risk than others. For example, patients with type 1 diabetes may struggle even more with blood glucose regulation when the thyroid becomes underactive. Other types of autoimmune diseases that may result in a higher risk of developing hypothyroidism include Addison’s disease, Cushing’s disease, fibromyalgia, systemic lupus erythematosus, and rheumatoid arthritis.

People who have had radiation exposure to the head and neck are also at increased risk of developing hypothyroidism. This may be more prominent among those who received radiation treatments as children, before the age of 20 years. Radiation exposure may be part of treatment for some medical conditions, including certain types of cancer affecting the head, neck, or chest. Additionally, some people received radiation therapy for infirmities such as tonsillitis, enlarged lymph nodes, or ringworm, when radiation was a standard form of treatment for these conditions during the time period between the 1920s to the 1960s. Increased exposure to radiation could cause an increased risk of hypothyroidism as well as thyroid nodules or cancer.

Women who become pregnant may be at increased risk of developing hypothyroidism, as the thyroid gland can become enlarged during pregnancy. Overall, women are more likely than men to develop hypothyroidism. An enlarged thyroid gland that develops during pregnancy may or may not affect thyroid function and may be a temporary situation until the baby is born. Following delivery, up to 10 percent of women may experience thyroid problems, known as postpartum thyroiditis, which may manifest as postpartum depression. These symptoms can last for up to one year postpartum and may be more common among women who already have autoimmune diseases.

Certain foods may affect thyroid function, placing a person at increased risk of developing hypothyroidism. Some foods that are known as goitrogens can impact thyroid activity by hindering the body’s ability to take up iodine. Some foods that are examples of goitrogens include Brussels sprouts, broccoli, turnips, radishes, cauliflower, kale, and rutabaga. Thyroid function is typically affected more when these foods are consumed raw in large amounts. Soy products may also reduce the body’s ability to produce thyroid hormone, due to some types of isoflavones found within these foods. This results in an increased risk of hypothyroidism for those who consume large amounts of soy, including soy foods and supplements, or soy-based infant formula.

Causes of Hypothyroidism
Hypothyroidism typically is not a disease that develops on its own, but is rather a condition that results from several potential causes. As previously stated, iodine deficiency has a direct cause on the development of hypothyroidism, because iodine is a necessary component of thyroid hormone molecules. Deficient iodine intake is measured as urinary iodine excretion of < 100 mcg/L. Many countries in the world that do not have access to iodized salt have greater instances of hypothyroidism and goiter. Additionally, there are several parts of the United States where hypothyroidism may be more likely to occur based on decreased iodine in soil content or previously flooded terrain, such as the Appalachian Mountains, North and South Dakota, Montana, Wyoming, and parts of Oregon and Washington.

For those who have been diagnosed with thyroid cancer, surgical removal of the gland may be necessary to prevent the spread of malignancy to other tissues. Surgical intervention may also be the prescribed treatment for thyroid nodules, although they are often benign. A large thyroid nodule that interferes with swallowing or speaking may necessitate removal of both the nodule and the gland. Even a goiter that has grown too large may need surgical removal. All of these conditions and their resulting treatments can be causes of hypothyroidism, as the patient may be left with a partial thyroid gland or none at all. This necessitates hormone replacement for life if the remaining thyroid tissue is not able to maintain adequate levels.

The most common disease that causes hypothyroidism is Hashimoto’s thyroiditis, an autoimmune disease that causes inflammation of the thyroid gland. This condition may also cause a goiter and occurs when the body attacks its own cells. Hashimoto’s thyroiditis leads to diminished thyroid function and subsequent hypothyroidism. It typically must be managed through lifetime hormone replacement. A second type of medical condition that may produce hypothyroidism is Graves’ disease. This disease actually causes hyperthyroidism and goiter and is the result of an autoimmune process. Hypothyroidism may develop following treatment for Graves’ disease, in which the patient may undergo radioactive iodine treatment or surgery to remove part of the thyroid gland.

**Pathophysiology of Disease Development**

The main function of the thyroid gland is to create thyroid hormone, which is essential for a variety of activities, including brain development, skeletal growth, immunity, proper functioning of the heart and lungs, production of steroid hormones, metabolism, and reproductive capabilities. The thyroid gland produces calcitonin and two other significant hormones, known as triiodothyronine (T3) and thyroxine (T4), which are jointly referred to as thyroid hormone. These hormones contain chemical structures that consist of iodine and amino acids known as tyrosine. When iodine molecules combine with tyrosine, the result is the thyroid hormones T3 and T4. These hormones are so named because of the number of iodine atoms found on each molecule: T4, or thyroxine, has four iodine atoms on each molecule, while T3, triiodothyronine, contains three atoms.

The release of thyroid hormones is controlled by structures in the brain, namely the hypothalamus and the pituitary gland. The hypothalamus senses when the body is in need of greater levels of thyroid hormones and so releases thyrotropin-releasing hormone.
(TRH). This in turn stimulates the pituitary gland to release thyroid-stimulating hormone (TSH), which tells the thyroid to increase productivity of thyroid hormones. As the levels of thyroid hormone increase in the body, the pituitary gland again senses the change in hormone levels and decreases TSH production.5

As the thyroid releases hormones into the bloodstream, the majority of T4 binds to thyroid transport proteins, which together travel to various body tissues. Once the T4 reaches certain types of cells, enzymes eliminate one of the iodine molecules, automatically converting the T4 to T3. Thyroid hormones work by binding to protein receptors on targeted cells, either on the cell membrane or within the mitochondria of the cell. The process of binding to a cell triggers a chemical reaction that stimulates cell metabolism.4

Hypothyroidism develops when the thyroid fails to produce enough thyroid hormone to support body processes. In 95 percent of cases, this occurs because of an inability of the thyroid to produce enough hormones, based on thyroid malfunction or failure, causing a condition known as primary hypothyroidism. If hypothyroidism occurs as a result of insufficiency of the pituitary gland, a patient is said to have secondary hypothyroidism.6 Because thyroid hormones affect so many different parts of the body, it may be difficult to detect hypothyroidism based on physical symptoms alone. Laboratory testing for thyroid levels may be necessary to determine the extent of hypothyroidism and to reveal the cause of the condition in order to control progression of the disease and prevent worsening of symptoms.6

**Hypothyroidism Testing and Diagnosis**

**Physical Symptoms**
The symptoms of hypothyroidism may vary between people with the disease. Symptoms may involve a variety of body systems, simply because thyroid hormones affect so many different processes throughout the body. One of the most common symptoms of hypothyroidism is weight gain of approximately 10 to 15 pounds,3 or an inability to lose weight despite attempts at healthy eating and exercise. Because thyroid hormones affect the body's metabolism, weight gain is a common occurrence for this state.

Some people suffer from a decreased body temperature, which manifests as feeling cold, even in warm temperatures. Lethargy and fatigue are also common symptoms associated with hypothyroidism. Some people make excuses for feeling tired, rationalizing that they are just too busy, while others are aware of a distinct drop in energy levels. Hypothyroidism may also manifest as an inability to concentrate or focus for even short periods of time. A person may have difficulties remembering tasks or even important events, or she may find herself feeling distracted during conversations. This has sometimes been referred to as a “haze” or “fog” of the brain to describe how the symptom really feels.7

Hypothyroidism may also manifest in multiple other ways, affecting numerous body systems, which is why testing is important if a patient presents with risk factors. The symptoms can be extremely varied, but may also include constipation and gastrointestinal disturbances, cracked or itchy skin, dry fingernails, hair loss, edema, increased blood
pressure, joint pain, infertility, painful menstruation, dizziness, headaches, and depression.  

A major aspect of diagnosing hypothyroidism is taking the patient’s symptoms, performing a physical exam, and taking personal history into account when checking laboratory values. Hypothyroidism may have similar symptoms to other conditions, such as fibromyalgia or depression. If a patient shows signs and symptoms of hypothyroidism and has relevant risk factors, the physician may order blood tests to determine the level of thyroid function.  

**Diagnostic Testing**

One of the main diagnostic tests for hypothyroidism is a test of the levels of thyroid-stimulating hormone (TSH), that secreted by the pituitary gland, which stimulates the thyroid to produce more hormones. Elevated levels of TSH indicate that the pituitary is trying to get the thyroid to increase more hormone production: that it is not creating enough. This is indicative of hypothyroidism when TSH levels run too high out of normal range. According to the American Association of Clinical Endocrinologists, normal levels of TSH usually run between 0.3 and 3 µU/mL. The TSH can indicate a problem with the thyroid or a potential problem with the pituitary gland. Depending on the results, it may be used in combination with other types of blood tests, such as a T4 test. This helps to pinpoint part of the cause of the hypothyroidism. For example, if TSH levels are elevated and T4 levels are low, these tests indicate that the pituitary gland is attempting to stimulate the thyroid to release more T4, and it is probably not responding, pointing to a problem with the thyroid gland. Alternatively, if TSH levels are normal but T4 levels are low, this type of hypothyroidism could be caused by pituitary failure in that the gland is not recognizing the diminished T4 levels.

The T4 test, used on its own, is reflective of thyroid function overall, and normal levels of T4 can indicate that the thyroid is working properly. The T4 test may also be combined with a T3 analysis to further determine thyroid function. In some situations, levels of T4 may be normal, but T3 levels may become elevated. For those who are not suffering from symptoms of hypothyroidism yet have abnormal T3 or T4 results, a measure of thyroid-binding globulin may be necessary. This test, called a resin T3 uptake test (RT3U), is a measurement of the amount of the protein that binds to thyroid hormone for transport throughout the body. If a person has low levels of thyroid-binding globulin, T4 levels may be abnormal, but this does not necessarily impact the effects of the hormone in the body, hence the lack of symptoms.

For the patient who may have a diagnosis of Hashimoto’s thyroiditis, an antibody test may be necessary to determine if the body is attacking its own cells. When the body attacks its own thyroid cells, it releases antibodies known as antithyroid peroxidase (TPO). Testing for anti-TPO can indicate the presence of an autoimmune condition in which the body is attacking the thyroid gland. Increased levels of anti-TPO can indicate the presence of Hashimoto’s thyroiditis.

Laboratory testing of thyroid hormones and antibodies are important components of diagnosing hypothyroidism. However, a diagnosis must be the result of several factors,
including patient symptoms, a physical exam, and a patient’s medical history. Creating a diagnosis based solely on laboratory values may or may not be an accurate picture of what the patient is experiencing.\textsuperscript{13}

**Medications that Cause Hypothyroidism**

**Drugs for Hyperthyroidism**

Treatment of hyperthyroidism may occur through the use of antithyroid drugs, which, if unsuccessful, could lead to further treatment measures and the development of hypothyroidism. Drugs used to treat hyperthyroidism typically include methimazole and propylthiouracil (PTU). Methimazole may be used in combination with beta-blockers to interfere with iodine organification and reduce the production of thyroid hormone. For patients who are pregnant, PTU may be the drug of choice. In both situations, thyroid levels must be consistently monitored over a period of several months with the goal result being a euthyroid state. Normally, thyroid levels are monitored throughout antithyroid drug therapy to reduce the incidence of hypothyroidism, which if it occurs, can be corrected by readjusting the dose. However, up to 50 percent of patients who begin treatment with antithyroid drugs will experience a relapse of hyperthyroidism, necessitating further means of treatment.\textsuperscript{15}

Further treatment of hyperthyroidism may cause thyroid hormone levels to swing the other way on the pendulum, resulting in hypothyroidism. One significant type of treatment that may be used to treat hyperthyroidism is radioactive iodine therapy, which uses a radioactive isotope, iodine-$\text{^{131}}$, to destroy thyroid tissue. Following treatment, up to 50 percent of patients develop hypothyroidism, which may occur several months later.\textsuperscript{13}

**Amiodarone**

Amiodarone may be a cause of both hyper- and hypothyroidism. Amiodarone is an antiarrhythmic used to treat or prevent several types of abnormal heart rhythms, including atrial fibrillation, atrial flutter, and stable ventricular tachycardia.\textsuperscript{14} Amiodarone contains a chemical structure similar to T4, including increased levels of iodine. Normally, increased iodine levels may indicate normal thyroid function or hyperthyroidism, but because amiodarone contains enough iodine, taking regular doses of the drug causes a large influx of iodine molecules that actually prevents the body from releasing thyroid hormone. This physiological process is known as the Wolff-Chaikoff effect and was first recognized in 1948.\textsuperscript{3}

**Perchlorate**

In certain cases in which a patient develops amiodarone-induced hyperthyroidism, a limited prescription of potassium perchlorate may provoke recovery if the condition is slow to improve or remission occurs. It may be used in conjunction with methimazole or propylthiouracil.\textsuperscript{14} Potassium perchlorate prevents the thyroid from accepting iodine, thereby preventing the development of thyroid hormones. It can have critical side effects, including agranulocytosis and aplastic anemia. Its iodine prevention measures may also cause hypothyroidism, so it may be used only on a limited basis, for a course of approximately 4 to 6 weeks.\textsuperscript{14}
Lithium
Lithium, when used to treat symptoms of some types of mental illness, may also induce hypothyroidism. The drug may contribute to this condition when it prevents the thyroid from producing necessary hormones. It may also impact how well the thyroid is able to secrete hormones to reach body tissues. According to the University of Maryland Medical Center, approximately 50 percent of patients who take lithium on a regular basis develop an enlarged thyroid or goiter, while 20 percent may have symptoms of hypothyroidism.

Hypothyroidism Treatment and Considerations
Thyroid replacement hormone
One of the main forms of treatment for hypothyroidism is that of hormone replacement to regulate body systems affected by thyroid hormones and to normalize levels. Synthetic thyroid replacement has been developed to replace low levels of hormones and can be regulated for potency. The most common form of synthetic thyroid hormone used is levothyroxine (brand names: Synthroid, Levothroid, Levoxyl), which is made up of a synthetic form of T4. Because T4 converts to the active hormone T3 in the body, this form of synthetic hormone does not consist of combination T4/T3, but instead relies on the conversion. It has a slow onset of approximately 3 to 5 days when compared with active T3.

Synthetic thyroid hormones may also appear in the form of combination T3 and T4 preparations. An example of this would be liotrix, which may be under the brand name Thyrolar. Liotrix has a T4 to T3 ratio of 4:1, although elevated levels of serum T3 may occur shortly after taking this medication. A standard initial dose is 30 mg, which is then increased based on patient thyroid hormone levels, and a typical maintenance dose runs between 60 and 120 mg/day. However, when compared with levothyroxine, the combination T3 and T4 found in liotrix offers little advantages over the former type of synthetic hormone and instead of being used for initial prescriptive therapy, it may be limited to those who are already established in drug therapy with levothyroxine.

Natural or organic forms of therapy may also be used in the treatment of hypothyroidism. One example of this is natural thyroid made from animal glands, which was a common form of treatment of hypothyroidism before synthetic substitutes were created. Some types of natural thyroid hormones available are known as Armour Thyroid, Nature-throid, and Biotech. They consist of natural T3 and T4 and may contain other hormones. They are not to be confused with nonstandard thyroid remedies that consist of ground up thyroid or other additives and are available over the counter. When starting therapy of prescriptive natural thyroid, the typical dose is approximately 30 mg and can be increased based on thyroid hormone level results to an average maintenance requirement between 60 and 120 mg/day. The U.S. Pharmacopeia requires an iodine content of hormone replacement to remain between 0.17 and 0.23%, so many of these thyroid extracts must have an additional filler to avoid exceeding this rate.

Pregnancy
Some women may experience changes in the size of their thyroid glands during pregnancy, however, this may or may not cause changes in thyroid hormone levels overall. Hypothyroidism may be difficult to recognize during pregnancy, as many of the symptoms are similar and may be attributed to body changes taking place with the growing fetus and altered pregnancy hormones. Diagnosis of hypothyroidism during pregnancy is confirmed with laboratory testing to check for changes in thyroid hormone levels. Treatment with hormone replacement may be prescribed during pregnancy, as the medication does not cross the placental barrier to affect the growing fetus. Thyroid hormone levels should be monitored throughout pregnancy to regulate medication dosages. Following delivery of the baby, additional monitoring is necessary to regulate thyroid hormones through medication as a woman’s body changes back to a pre-pregnancy state in the months following delivery. Uncontrolled hypothyroidism may lead to increased feelings of depression, exhaustion, inability to lose weight, and difficulties with breastfeeding following pregnancy.\textsuperscript{10}

**Subclinical Hypothyroidism**

There are some situations in which a patient may present with symptoms of hypothyroidism, may have iodine deficiency, or may have developed a small goiter, and yet her clinical laboratory values show TSH levels within what is considered the normal range, or at the upper end of “normal.” This situation may be referred to as subclinical hypothyroidism, in which a patient suffers from the effects of too little thyroid hormone, but may not have TSH levels that match the symptoms. Diagnosis of hypothyroidism can be confusing for some practitioners if patients present with symptoms that differ from expected laboratory values.\textsuperscript{13}

Subclinical hypothyroidism may be treated by some physicians, while others may follow the guidelines of laboratory values a little more strictly. The patient’s history and physical examination are critical elements of diagnosis in these situations, as failure to treat subclinical hypothyroidism may eventually lead to total hypothyroidism, as well as require the patient to suffer from difficult symptoms unnecessarily. The prescription of thyroid hormone replacement for hypothyroidism depends on the case at hand, including symptoms and medical history, as well as laboratory values.\textsuperscript{13} The following describes a short case study as an example of this situation:

A 37-year-old female with a history of a benign thyroid nodule is seen for impaired swallowing, and is scheduled for surgical removal of the nodule and a partial thyroid lobectomy. Prior to surgery, her TSH levels were within normal range of 0.9 \( \mu \)IU/mL and she had a history of infertility and weight gain. She underwent surgery to remove both the nodule and the right thyroid lobe, leaving the left lobe intact. Three months following the procedure, she experiences muscle and joint pain, an inability to lose weight, depression, edema, and exhaustion. Her TSH levels have risen to 3.3 \( \mu \)IU/mL, while retaining normal T4 and T3 levels.

While this patient has not technically experienced a great spike in TSH levels following surgery, her thyroid hormone levels are higher than where she normally functions, even
with a previous thyroid nodule. Her additional symptoms may lead her practitioner to begin a prescription of thyroid hormone replacement based on two factors:

1. Her thyroid hormone levels have risen following surgery, and while technically not out of range, they are higher than her normal levels. Without treatment, they may continue to rise as the left thyroid lobe tries to keep up with the body’s needs, eventually leading to full-blown hypothyroidism without treatment.
2. The patient is experiencing a worsening of symptoms than prior to her surgical procedure. Beginning treatment with thyroid replacement hormone may reduce the effects of some negative symptoms.

There are some physicians who argue that treating subclinical hypothyroidism may involve screening, diagnosis and treatment for many unnecessary situations. According to the Journal of Clinical Endocrinology and Metabolism, subclinical hypothyroidism may exist in up to 4 to 10 percent of the population overall. Some physicians may prefer to wait and see if thyroid hormone levels continue to rise out of range before fully diagnosing hypothyroidism and prescribing treatment, stating that mildly elevated thyroid levels and negative symptoms could be the result of a transient condition, such as thyroiditis. However, mild TSH elevation and associated symptoms should be at least monitored for changes to ensure that the condition either resolves or causes further deterioration.

**Medication Considerations**

Prescription medication for thyroid replacement has value in alleviating many negative symptoms associated with hypothyroidism as well as regulating TSH, T4, and T3 levels for many patients. However, there are some factors to consider when prescribing and dispensing the various formulations for thyroid replacement.

Natural, organic, or desiccated thyroid derived from animals may work as effectively as synthetic versions of thyroid replacement. However, because these hormones come from animals, there may be variable amounts of T4 or T3 within the formulas due to potential imbalances or unpredictability between batches. Some patients may also be at risk of developing allergic reactions to these products, and in some situations, patients may oppose the use of animal products for this purpose due to personal or religious reasons. Alternatively, natural thyroid preparations may also provide an improvement in psychological symptoms associated with hypothyroidism, such as depression.

Synthetic hormone formulations produce more uniform concentrations of T4 and T3 within their combinations because of the preparation process. This reduces the instances of allergies and regulates the amount of hormone the patient is actually receiving. Levothyroxine may have a slower onset (approximately 3 to 5 days) than natural thyroid preparations and its effects may be diminished among those with gastrointestinal conditions that affect absorption.

Levothyroxine is also affected by light and temperature and should be kept in a temperature and humidity-controlled environment to protect its potency. The standard dose at the beginning of therapy is typically 50 mcg/day for those under 45 years;
however, this may be increased based on symptoms and laboratory results. An average maintenance dose of this medication is between 100 and 120 mcg/day, which may need to be increased among women who are pregnant. Patients older than 50 years may start therapy at 25 mcg/day and increase in dosage depending on symptoms at a rate of 25 mcg per increase. Careful dosage considerations must be taken into account for patients who suffer from cardiovascular disease, as levothyroxine could cause increased stress on the heart and cardiovascular system.\textsuperscript{16}

Dosage adjustments and laboratory testing should occur approximately every 4 to 6 weeks to avoid checking levels again too soon or alternatively, not often enough. Patients who have negative symptoms associated with hypothyroidism may start to see resolution of symptoms within 2 to 3 weeks. Concomitant drug therapy with lithium or amiodarone may affect the drug’s ability to control thyroid hormone levels. Additionally, some drugs such as iron supplements (ferrous sulfate) or aluminum antacids may affect the body’s ability to absorb levothyroxine.\textsuperscript{16}

Side effects of drug therapy for hypothyroidism are symptoms of hyperthyroidism when too much of the drug is prescribed. Patients may develop such symptoms as anxiety, irritability, heat intolerance, excessive sweating and weight loss. Cardiovascular side effects may include angina, myocardial infarction, or congestive heart failure, which further points to the importance of regular screening for dose maintenance and adjustment when necessary.\textsuperscript{16}

Proper diagnosis and treatment of hypothyroidism is essential to bring thyroid hormone levels back into the normal range and to prevent the sometimes-debilitating symptoms associated with this condition. For those diagnosed with hypothyroidism, treatment modalities that include synthetic or natural hormone replacement, as well as proper self-care measures, can considerably improve symptoms and impact quality of life.
References