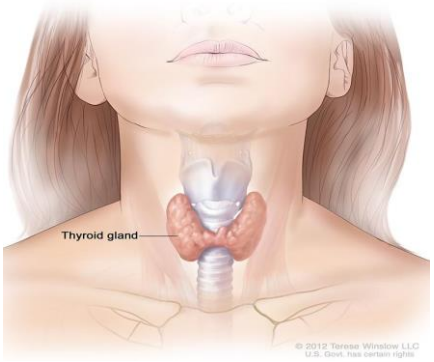
Hypothyroidism

Introduction

Definition and Overview:

Hypothyroidism is also called underactive thyroid, is when the thyroid gland doesn't make enough thyroid hormones in the bloodstream to meet your body's needs. The thyroid is a small, butterfly-shaped gland in the front of your neck.



Historical Context:

In 1850, the first case of hypothyroidism or myxedema was described. Myxedema is **a term used synonymously with severe hypothyroidism**. However, the term is also used to describe a dermatological change that can occur in hypothyroidism and (rare) paradoxical cases of hyperthyroidism.

Epidemiology:

The prevalence of hyperthyroidism in women is between 0.5 and 2% and is ten times more common in women than in men. Epidemiological studies suggest that 1% of men and 5% of women have thyroid nodules detected clinically and that the frequency increases with age and in iodine-deficient populations.

Etiology

Causes and Risk Factors:

The thyroid gland produces hormones T-4 and T-3, which regulate body temperature, heart rate, and protein production. So, hypothyroidism occurs when the gland lacks sufficient hormones.

Autoimmune disease: it is also called Hashimoto’s disease, an autoimmune disease, and is the most common cause of hypothyroidism, which affects the thyroid gland's hormone production.

Thyroid surgery: the thyroid gland's ability to produce thyroid hormones can be reduced or completely stopped by surgery.

Radiation therapy: it is used to treat cancers of the head and neck can affect the thyroid gland and lead to hypothyroidism.

Thyroiditis: it is caused by inflammation of the thyroid gland, can lead to hyperthyroidism, a sudden release of stored hormones, and subsequent underactivity.

But less often, hypothyroidism may be caused by:

Pregnancy: hypothyroidism is a condition that can occur during or after pregnancy, can increase the risk of pregnancy loss, premature delivery, preeclampsia, and negatively impact the developing fetus. That's why the rate of woman suffering from hypothyroidism is more than that of men.

Not enough iodine: Iodine, found in seafood, seaweed, and iodized salt, is essential for thyroid hormone production. Insufficient intake can lead to hypothyroidism, a condition often caused by insufficient iodine intake. But it is less likely to cause hypothyroidism.

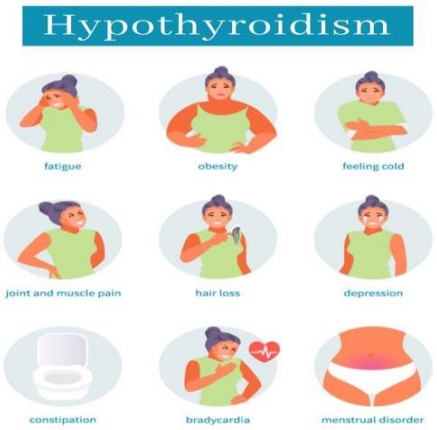
Although anyone can develop hypothyroidism, you're at an increased risk if you are a woman. If having a family history of thyroid disease, or an autoimmune disease, such as type 1 diabetes. Or if you receive treatment for hyperthyroidism, radiation to your neck or upper chest, or had thyroid surgery.

Genetic and Environmental Influences:

Genetics play a role in hypothyroidism (underactive thyroid), environmental factors are also involved such as exposure to tobacco smoke and certain viruses. Exposure to certain synthetic pesticides, fungicides, and herbicides. People have an increased risk of developing hypothyroidism if exposed to pesticides, fungicides, and herbicides. Also, hyperthyroidism has an important genetic component. Many cases of hyperthyroidism arise because an individual has a mutation in one or more genes. These mutations alter typical thyroid function, causing it to produce too much T4 and T3.

Clinical Features

Signs and Symptoms:



Hypothyroidism can lead to fatigue and weight gain, which may become more noticeable as metabolism slows. Its symptoms may include: More sensitivity to cold (wearing a sweater when others are wearing a t-shirt), slowed heart rate and it is also called bradycardia, having puffy face in this case the face is a bis swollen, muscle weakness, muscle aches, tenderness and stiffness, depression and memory problems.

In general, children and teens with hypothyroidism have symptoms like those in adults. But they also may have poor growth that leads to short stature, delayed development of permanent teeth and can have poor mental development.

Disease Stages and Progression:

Thyroiditis has three phases which are:

Thyrotoxic phase: The thyroid is swollen and releases too many hormones.

Hypothyroid phase: After a few weeks or months, too much of the thyroid hormone is released and leads to hypothyroidism, when you don't have enough left.

Euthyroid phase**:** In this phase, thyroid levels are normal. It can happen between the first two phases or at the end, after the swelling has gone down.

Complications:

Hypothyroidism that isn't treated can lead to other health problems and serious complications, including:

Hypothyroidism can lead to a condition called **goiter**, which can cause the thyroid gland to grow larger, potentially causing issues with swallowing or breathing.

Hypothyroidism increases **heart disease and heart failure risk** due to high levels of "bad" cholesterol, specifically low-density lipoprotein (LDL) cholesterol.

Also, long-term hypothyroidism can cause **peripheral neuropathy**, affecting nerves that transmit information from the brain and spinal cord, causing pain, numbness, and tingling in arms and legs.

The hypothyroidism caused by low thyroid hormone levels can hinder fertility, and **autoimmune disorders**, among other causes, can also negatively impact fertility.

Untreated thyroid disease can increase the risk of **birth defects** in babies born to mothers with thyroid disease compared to those without thyroid disease.

Finally, **Myxedema coma**, a rare, life-threatening condition triggered by prolonged hypothyroidism, presents symptoms like cold intolerance, drowsiness, energy deficiency, and unconsciousness, necessitating immediate medical attention.

Diagnosis

Diagnostic Criteria:

The first blood test typically done to diagnose hypothyroidism measures the level of thyroid-stimulating hormone (TSH) in the blood. If it's high, the test is done again, along with a blood test for the thyroid hormone T-4. If the results show that TSH is high and T-4 is low, then the diagnosis is hypothyroidism.

Diagnostic Tests and Procedures:

A blood test measuring your hormone levels is the only accurate way to find out whether there's a problem. The test, called a thyroid function test, looks at levels of thyroid-stimulating hormone (TSH) and thyroxine (T4) in the blood. Doctors may refer to this as "free" T4 (FT4).

Differential Diagnosis:

Differential diagnosis is based on signs and symptoms, for example : fatigue can point to iron deficiency anemia, sleep apnea, depression, and rheumatological diseases.

Pathophysiology

Mechanisms of Disease Development:

An underactive thyroid often occurs when the immune system, which usually fights infection, attacks the thyroid gland as well. This damages the thyroid glands, which means it's not able to make enough of the thyroxine hormone, leading to the symptoms of an underactive thyroid. But the most common cause of primary hypothyroidism is chronic autoimmune thyroiditis (Hashimoto's disease), in which the thyroid is destroyed by antibodies or lymphocytes that attack the gland.

Cellular and Molecular Changes:

Thyroid hormone regulates cellular energy (ATP) demand and utilization in the developing brain, through its regulation of genes involved in cellular energy metabolism and in stimulation of ATP-consuming processes. In some individuals, the immune system may mistake thyroid gland cells and enzymes for invaders, leading to insufficient thyroid hormone production.

Impact on Body Systems:

Hypothyroidism is also known as underactive thyroid and it is a condition where the thyroid fails to produce enough thyroid hormone, causing metabolism to slow down and fatigue causing weight gain and inability to tolerate cold temperatures. Hypothyroidism also can affect the heart and circulatory system in several ways.

Management and Treatment:

Medical and Surgical Treatments:

Since hypothyroidism is a lack of thyroid hormone, the treatment is simple to give the patient thyroid hormone in pill form. Most commonly, patients are given T4 (Synthroid or levothyroxine). Thyroid hormone pills are essentially what the body

normally produces, just in pill form. Hypothyroidism is usually treated by taking daily hormone replacement tablets called levothyroxine. It can be treated surgically too including the removal of all or part of the thyroid gland.

Pharmacological Therapies:

The treatment for hypothyroidism usually includes taking the thyroid hormone medicine levothyroxine (Levo-T, Synthroid, others) every day. This medicine is taken by mouth. It returns hormone levels to a healthy range, eliminating symptoms of hypothyroidism.

Lifestyle and Dietary Modifications:

The way you eat can improve your health and may make hypothyroidism easier to manage, too. To make the most of every meal: Eat a Mediterranean-style diet. The foundation of the Mediterranean diet is plant foods. That means meals are built around vegetables, fruits, herbs, nuts, beans and whole grains. Moderate amounts of dairy, poultry and eggs are part of the Mediterranean diet, as is seafood.

To sum up ,In general, the best diet for a person with hypothyroidism contains plenty of fruits, vegetables, filling proteins, healthy fats, and moderate amounts of healthy carbohydrates.

Rehabilitation and Supportive Care:

The care plans for hypothyroidism patients should consider this risk and focus on promoting rest and adequate sleep, conserving energy during activities of daily living, and optimizing thyroid hormone replacement therapy to improve energy levels and reduce fatigue.

There are some home remedies and natural treatments that may help a person manage symptoms of hypothyroidism. These include reducing their intake of sugar and processed foods and getting more vitamin B12 and selenium. But take in consider that most people require medication for hypothyroidism

Prevention and Control

Primary, Secondary, and Tertiary Prevention Strategies:

Unfortunately, hypothyroidism in its primary stage cannot be prevented but iodine intake may help a lot, in case of undergoing thyroid tests after thyroid surgery or therapy could result in early detection and prompt treatment of hypothyroidism.

The secondary prevention could involve screening of in- dividuals for thyroid nodules, or, more commonly, identi- fying subclinical hyperthyroidism or hypothyroidism with TSH testing.

While the tertiary prevention is the optimization of medical care and management to improve an already established disease and avoidance of complications and disabilities (presence of sign and symptoms).

In general, prevention of hypothyroidism can be achieved with the following:

Increase in iodine intake: Iodine intake is the foremost prevention strategy in hypothyroidism.

Early detection**:** Undergoing thyroid tests after thyroid surgery or therapy could result in early detection and prompt treatment of hypothyroidism.

Public Health Interventions:

If nursing someone with hypothyroidism, then some tips must be followed such as:

Protect against coldness: an extra layer of clothing or extra blanket must be provided to the patient but it is preferred to avoid the use of external heat source as well and monitor patient's body temperature.

Increase fluid intake: Encourage increased fluid intake within the limits of fluid restriction.

Vaccination and Screening Programs:

The screening tool for hypothyroidism is blood test as the thyroid hormone is secreted there, also screening for congenital hypothyroidism is recommended to newborn babies when they are three days old. Some people are at high risk, such as the following: Pregnant women. Women older than 60 years. Patients with type 1 diabetes or other autoimmune disease.

Prognosis

Disease Outcomes and Survival Rates:

Without treatment, hypothyroidism may have a risk of high morbidity and mortality and can eventually lead to coma or even death. In children, failure to treat hypothyroidism can result in severe mental retardation. A leading cause of death in adults is heart failure.

But with treatment, most people living with hypothyroidism see no significant decline in life expectancy, and problematic symptoms typically resolve in weeks to months.

Factors Influencing Prognosis:

In children, failure to treat hypothyroidism can result in severe mental retardation. A leading cause of death in adults is heart failure. Most patients have a good prognosis with treatment, and the symptoms usually reverse in a few weeks or months. Furthermore, High iodine intake, age, women Presence of TPO Ab and smoking status contribute to Hypothyroidism.

Quality of Life:

The persistent poor quality of life may be the result of the common symptoms of hypothyroidism found such as weight gain, fatigue, and loss of energy which are not significant in treatment.

Current Research and Future Directions

Recent Advances and Discoveries:

Hypothyroidism is a decreased activity of the thyroid gland which may affect all body functions. The rate of metabolism slows causing mental and physical sluggishness. The most severe form of hypothyroidism is **myxedema**, which is a medical emergency. The latest research about hypothyroidism stated that older people with hypothyroidism may be at increased risk of developing dementia.

Ongoing Clinical Trials:

Number of ongoing Clinical Trials (for drugs) involving Hypothyroidism by Phase, there are currently 73 ongoing clinical trials involving Hypothyroidism. Of the 73 trials,27 trials are in Phase II. Furthermore, 21 trials are in Phase IV.

Future Research Needs:

Some examples of future research needs include the development of superior biomarkers of euthyroidism to supplement thyrotropin measurements, mechanistic research on serum triiodothyronine levels (including effects of age and disease status, relationship with tissue concentrations, as well as potential therapeutic).

Case Studies

Example Cases:

Kelly Clarkson is an American singer, songwriter, and television personality. Despite her success, she faced significant health challenges. She reported experiencing several symptoms such as: Fatigue, weight gain, depression, dry skin and hair loss, constipation and cold intolerance. And these symptoms gradually worsened over time.

Kelly underwent a series of blood tests including Thyroid-stimulating hormone (TSH) and Free thyroxine (T4). Then the results showed high TSH and low T4 levels, confirming hypothyroidism.

Doctors made a treatment plans for Kelly that involved:

Medication: she was prescribed levothyroxine, a synthetic thyroid hormone that helps restore normal hormone levels.

Diet and Lifestyle Changes: a diet which is rich in nutrients that support thyroid function, such as iodine, selenium, and zinc and regular exercise and stress management techniques were also added into her routine.

Regular Monitoring: regular check-ups and blood tests were scheduled to monitor hormone levels.

Considering the treatment and the new lifestyle, Kelly Clarkson successfully managed her hypothyroidism and she reported that her state is improving her symptoms as weight stabilized and overall her well-being state.

Kelly Clarkson was open with her health state which helped in increasing the awareness of this disease, her state encouraged many fans and people to check the doctor if they face the same symptoms.

In conclusion, the proper diagnosis, treatment, and lifestyle changes can significantly improve the quality of life for individuals with this condition.