

Supportive module 1: “Essentials of diagnosis, treatment and prevention of major endocrine diseases”

3.	Diseases of the thyroid gland. Goiter: diagnosis, differential diagnosis, prevention and treatment.	2	20/09
4.	Diseases of the adrenal glands. Chronic adrenal insufficiency. Hormonally active tumors.	2	27/09
5.	Diseases of the hypothalamic-pituitary system. Its part in correction of the functional activity of the endocrine glands.	2	04/10

Essentials of Diagnosis, Treatment and Prevention of Major Endocrine Diseases: Diseases of the Thyroid Gland. Goiter.

LECTURE IN INTERNAL MEDICINE FOR IV COURSE STUDENTS

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Plan of the Lecture



- Definition
- Epidemiology
- Mechanisms
- Classification
- Clinical presentation
- Diagnosis
- Treatment
- Prognosis
- Prophylaxis
- Abbreviations
- Diagnostic guidelines

Definition

Diseases of the Thyroid Gland

Diseases of the thyroid gland result from primary or secondary autoimmune (80%) and from non autoimmune (20%) processes that either stimulate the overproduction of thyroid hormones (*thyrotoxicosis*) or cause glandular destruction and hormone deficiency (*hypothyroidism*); in addition, benign nodules and various forms of thyroid cancer are relatively common and amenable to detection by physical examination; all of them have a large range of symptoms and affect all ages.

Definition

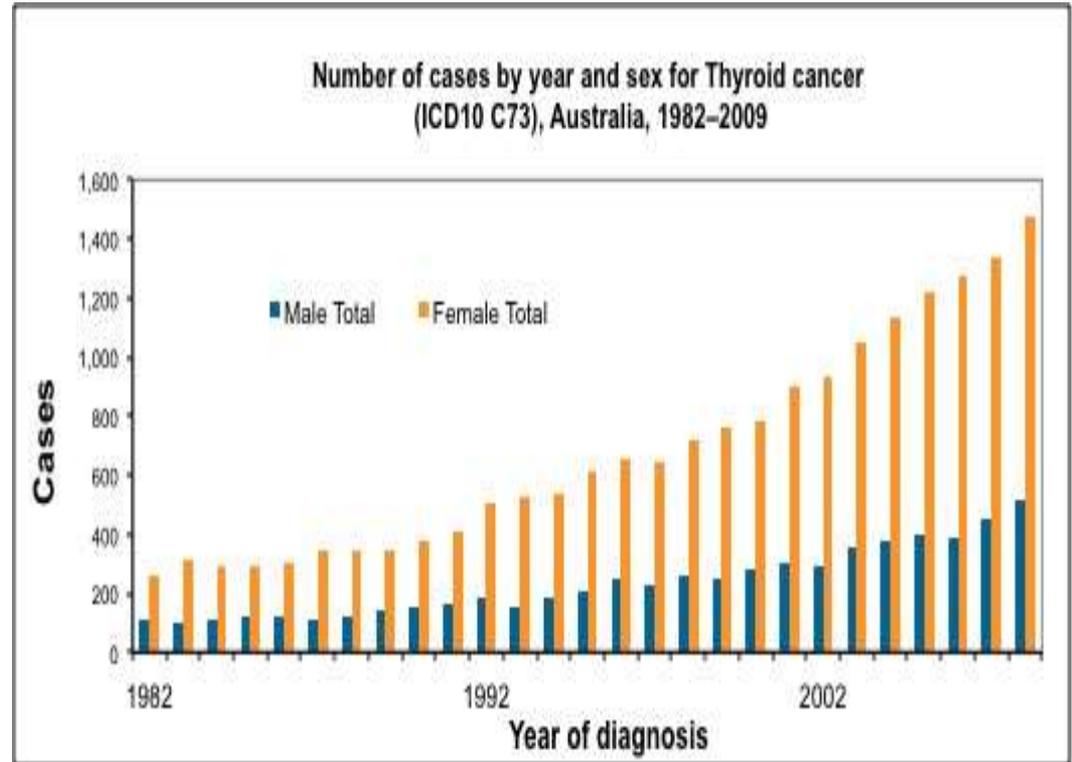
Goiter

- A goiter (American English) or goitre (British English) (from the Latin *gutteria*, *struma*) is a swelling of the neck or larynx resulting from enlargement of the thyroid gland (thyromegaly), that is not functioning properly
- Worldwide, over 90% cases of goitre are caused by iodine deficiency

Epidemiology

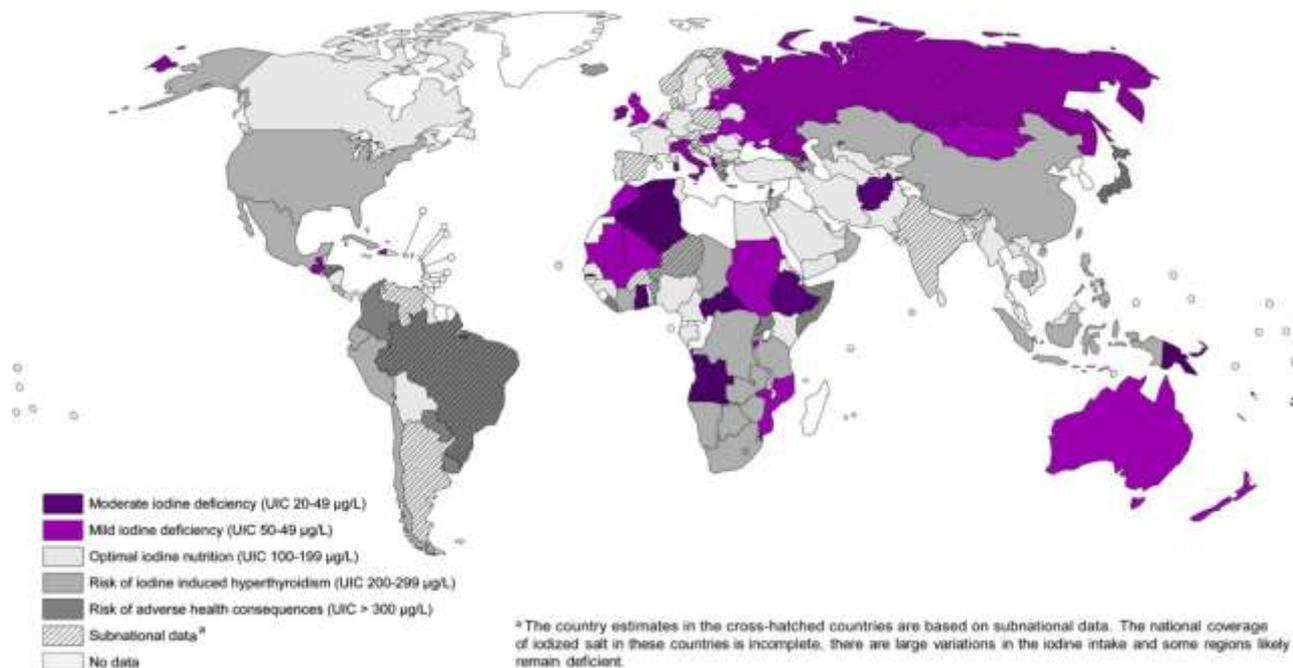
Diseases of the Thyroid Gland

- The prevalence of thyroid dysfunction in adults in the general population ranges from 1% to 10 %, and is even higher in selected groups
- About 200 million people in the world have some form of thyroid disease
- Women are generally more susceptible than men with a female : male ratio of 4:1
- The incidence increases by age



Epidemiology

Goiter



Countries classified by iodine nutrition according to degree of public health importance. Iodine intake is inadequate in 32 countries, adequate in 71, more than adequate in 36, and excessive in 11

Risk Factors

Diseases of the Thyroid Gland 1

- Gender: women are anywhere from 6 to 8 times more likely than men to develop a thyroid condition
- Age: being 50 and above increases the risk of thyroid disease
- Personal history of thyroid disease increases current risk for its development
- Family history of thyroid disease increases risk for its development
- Thyroid surgery: surgical removal of all or part of the thyroid usually results in hypothyroidism
- Radioactive iodine treatment (RAI) to the thyroid usually results in hypothyroidism
- Pregnancy: the risk of developing thyroid disease increases slightly while pregnant or during the first-year postpartum
- Cigarette smoking increases risk of developing autoimmune thyroid disease
- Use of iodine or supplements containing iodine increases the risk of autoimmune thyroid disease and hypothyroidism, and hyperthyroidism or thyrotoxicosis

Risk Factors

Diseases of the Thyroid Gland 2

- Iodine Deficiency increases the risk of hypothyroidism and goiter
- Certain medical treatments and drugs (campsath-1H), bone marrow transplant, lithium, amiodarone, etc.) increase the risk of developing an underactive thyroid (interferon beta-1b, interleukin-4, immunosuppressants, antiretrovirals, monoclonal antibody Goitrogenic Foods
- Some foods (cabbage, Brussels sprouts, broccoli, turnips, rutabagas, kohlrabi, radishes, cauliflower, African cassava, millet, kale, and soy) naturally contain chemicals that can promote goiter and cause hypothyroidism
- Radiation exposure, such as in medical treatments for head or neck cancer, increases the risk of autoimmune thyroid disease, and thyroid cancer
- Distress is considered an environmental factor for autoimmune thyroid disease
- Neck surgery/Trauma slightly increases risk of hypothyroidism or thyroiditis
- Other factors

Risk Factors

Goiter

Some common risk factors:

- A lack of dietary iodine in areas where iodine is in short supply and where people don't have access to iodine supplements
- Being female
- Age: chances of developing a goiter increase with age
- A personal or family history of autoimmune disease
- Pregnancy and menopause
- Certain medications (immunosuppressants, antiretrovirals, amiodarone, lithium)
- Risk increases with radiation exposure.

Etiology

Diseases of the Thyroid Gland 1

- Diseases of the thyroid gland sometimes result from inappropriate thyroid stimulating hormone (TSH) levels, or may be caused by problems in the thyroid gland itself
- The most common cause of hypothyroidism is *Hashimoto's thyroiditis*, and other causes include iodine deficiency (rare in mountain areas), pituitary and hypothalamus problems
- The most common causes of hyperthyroidism are 1) *Graves' disease*, that occurs when the immune system produces an antibody that stimulates the entire thyroid gland and leads to its overactivity thru increased levels of thyroid hormones; 2) *toxic nodular goiter* or *toxic thyroid adenoma*, that constantly produce thyroid hormones even when they are not needed; 3) the pituitary gland overactivity (e.g., pituitary tumours) with hypersecretion of TSH, leading to constant stimulation of the thyroid gland; 4) *thyroiditis*, this may lead to temporary hyperthyroidism that might be followed by hypothyroidism

Etiology

Diseases of the Thyroid Gland 2

- There are four types of thyroid cancers:
 - *Papillary*
 - *Follicular*
 - *Anaplastic*
 - *Medullary*
- Most of thyroid cancers are associated with radiation treatment to the head, neck, or chest
- In other cases, a genetic mutation might be associated with thyroid cancer, either alone or in conjunction with other types of cancers (e.g., multiple endocrine neoplasia, BRAF gene mutations)
- Less commonly, other cancers might metastasize to the thyroid (e.g., lymphoma, breast cancer).

Etiology

Goiter

- Goiter refers to a condition where the thyroid gland is enlarged in size
- Goiter can result from autoimmune Hashimoto's and Graves' diseases, iodine excess and deficiency, and nodular thyroid disease.



Etiology 3

Goiter

- Worldwide, the most common cause for goiter is iodine deficiency, usually seen in countries that do not use iodized salt
- Selenium deficiency is also considered a contributing factor
- In countries that use iodized salt, Hashimoto's thyroiditis is the most common cause
- Goiter can also result from cyanide poisoning, this is particularly common in tropical countries where people eat the cyanide-rich cassava root as the staple food.



Cassava or manioc

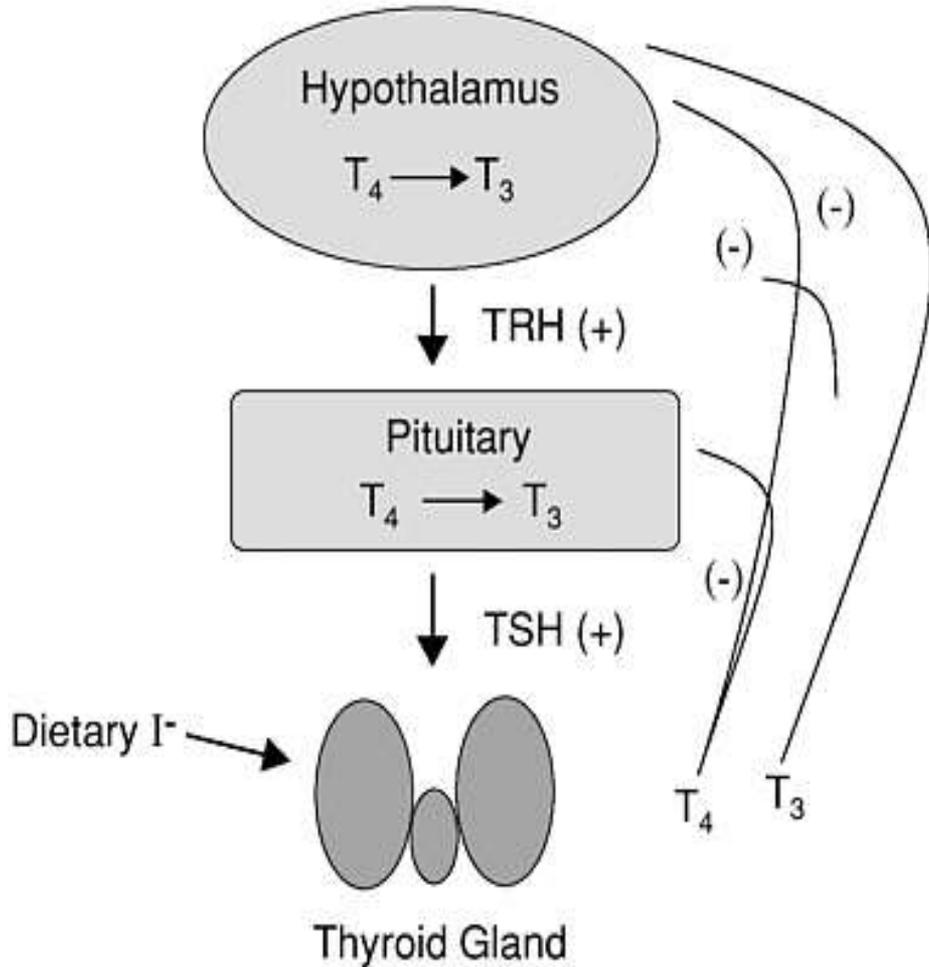
Mechanisms

Diseases Thyroid Gland

- Disorders of the thyroid are functional—caused by dysfunction in the production of hormones, and nodes and tumors either benign or malignant
- Functional disorders can result in the overproduction or underproduction of hormones
- Functional disorders can cause inflammation in forms of Hashimoto's thyroiditis and postpartum thyroiditis
- Hashimoto's thyroiditis is an autoimmune inflammatory disorder whereby the body's own immune system reacts with the thyroid tissues in an attempt to destroy it with reactive inflammation, in result at the beginning, the gland may be overactive, and then becomes underactive, and some patients may experience "swings" in hormone levels that can progress from hyper-to-hypothyroid with comorbid development of type 1 diabetes and celiac disease
- Postpartum thyroiditis occurs in some females following the birth of a child, when the gland becomes inflamed as in Hashimoto's thyroiditis
- Any of the functional thyroid disorders can result in the gland's enlargement and cause a swollen neck termed a goiter

Mechanisms

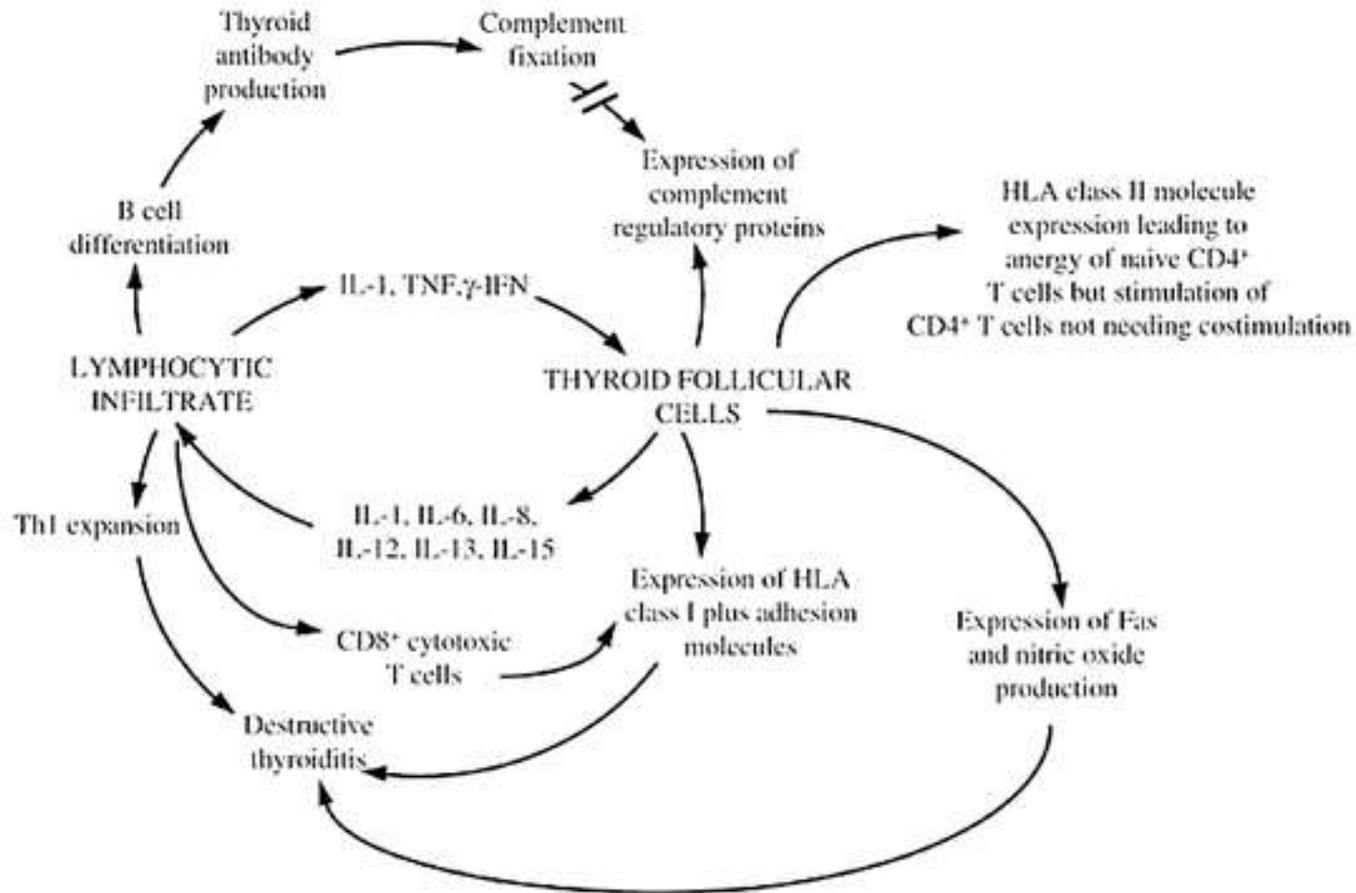
Diseases Thyroid Gland: Pathological in Physiological



- TSH, secreted by thyrotrophic cells located in the anterior pituitary gland, regulates thyroid gland function and hormone synthesis and release
- The pituitary secretion of TSH in turn is influenced by the releasing factor, thyrotropin-releasing hormone (TRH) produced in the hypothalamus
- The secretion of both TSH and TRH is regulated by negative feedback from thyroid hormone, predominantly T_3 , from the circulation and/or T_3 that is produced locally from intracellular conversion of T_4 to T_3 .

Mechanisms

Diseases Thyroid Gland: Local Humoral Factors



Interactions between thyroid follicular cells and the immune system in autoimmune thyroid disease

Classification

International Classification of Diseases (ICD)

IV Endocrine, nutritional and metabolic diseases

(E00-E07) Disorders of thyroid gland

E00 Congenital iodine-deficiency syndrome

E01 Iodine-deficiency-related thyroid disorders and allied conditions

E02 Subclinical iodine-deficiency hypothyroidism

E03 Other hypothyroidism

E04 Other nontoxic goitre

E05 Thyrotoxicosis [hyperthyroidism]

E06 Thyroiditis

E07 Other disorders of thyroid

Classification

Goiter Morphology

Regarding morphology, goiter may be classified either as the growth pattern or as the size of the growth:

- Growth pattern
 - uninodular goiter: can be either inactive or a toxic
 - multinodular goiter: can likewise be inactive or toxic
- Diffuse goiter when the whole thyroid appearing to be enlarged;
 - Class I size: in normal posture of the head, it cannot be seen; it is only found by palpation
 - Class II size: the goiter is palpable and can be easily seen
 - Class III size: the goiter is very large and is retrosternal, pressure results in compression marks.

Classification

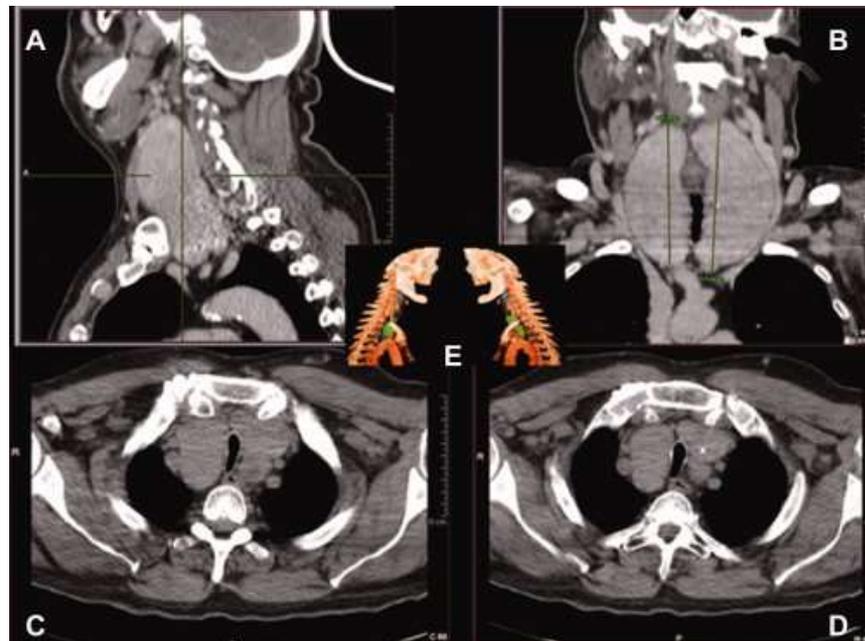
WHO of Goiter' Grade

Grade 0 – no goiter presence is found (the thyroid impalpable and invisible)

Grade 1 – neck thickening is present in result of enlarged thyroid, palpable, however, not visible in normal position of the neck; the thickened mass moves upwards during swallowing

Grade 1 includes also nodular goitre if thyroid enlargement remains invisible

Grade 2 – neck swelling, visible when the neck is in normal position, corresponding to enlarged thyroid – found in palpation



Substernal goiter, grade 1 type A bilateral.

(a) Cranio-caudal extension of the substernal goiter. (b) Substernal goiter with bilateral extension. (c,d) Substernal goiter with bilateral extension at the level of the thoracic inlet.

Classification

Inflammatory Forms

- Acute thyroiditis (suppurative thyroiditis, microbial inflammatory thyroiditis, pyrogenic thyroiditis, bacterial thyroiditis) is caused by a bacterial infection, fungal or parasitic infection, in an immunocompromised host
- Subacute thyroiditis, in the most common subacute granulomatous form, or de Quervain's, manifests as a sudden and painful enlargement of the thyroid gland accompanied with fever, malaise and muscle aches
- Silent thyroiditis (subacute lymphocytic thyroiditis, painless thyroiditis) may occur at any age and is more common in females as subtype of Hashimoto's thyroiditis and have an autoimmune basis
- Riedel's thyroiditis (Riedel's struma, IgG4-related disease) is one of manifestations of a inflammatory chronic systemic multi-organ disease affecting pancreas, liver, kidney, salivary and orbital tissues and retroperitoneum with fibrosis and infiltration by IgG4 secreting plasma cells
- Palpation thyroiditis refers to the development of thyroid inflammation due to mechanical damage to thyroid follicles by repeated palpation or surgical manipulation in neck area.

Classification

Forms of Clinical Manifestation

- Functional disorders
 - Low function - Hypothyroidism (Hashimoto's thyroiditis / thyroiditis, Ord's thyroiditis, postoperative hypothyroidism, postpartum thyroiditis, silent thyroiditis, acute thyroiditis, iatrogenic hypothyroidism, thyroid hormone resistance, euthyroid sick syndrome)
 - High function - Hyperthyroidism (thyroid storm, Graves' disease, toxic thyroid nodule, toxic nodular struma (Plummer's disease), Hashitoxicosis)
- Nodular abnormalities - Goitre (endemic goitre, diffuse goitre, multinodular goitre, lingual thyroid, thyroglossal duct cyst)
- Tumors (thyroid adenoma, thyroid cancer (papillary, follicular, medullary, anaplastic}, lymphomas and metastasis from elsewhere (rare))
- Deficiencies (congenital hypothyroidism which untreated can lead to cretinism)

Classification

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Clinical Investigation

Common Symptoms and Signs

- Nervousness and tremor (hyperthyroidism)
- Mental fogginess and poor concentration (hyperthyroidism and hypothyroidism)
- Menstrual changes (hypothyroidism is associated with excessive or prolonged menstrual bleeding, while hyperthyroidism characterized by scanty or reduced menstrual flow)
- Feeling bloated (hypothyroidism)
- Racing heartbeat (hyperthyroidism)
- Aches and pains (hyperthyroidism and hypothyroidism)
- Weight gain (hypothyroidism)
- High cholesterol levels (hypothyroidism)
- Heat intolerance (hyperthyroidism)
- Feeling cold (hypothyroidism)

Clinical Investigation

Hypothyroidism

- Coarse and dry hair
- Confusion or forgetfulness (often mistaken for dementia in seniors)
- Constipation
- Depression
- Dry, scaly skin
- Fatigue or a feeling of sluggishness
- Hair loss
- Increased menstrual flow (women)
- Intolerance to cold temperatures
- Irritability
- Muscle cramps
- Slower heart rate
- Weakness
- Weight gain

Clinical Investigation

Severe form of Hypothyroidism (Myxedema)

- Low body temperature
- Dulled mental processes
- Congestive heart failure
- Myxedema coma (loss of consciousness, seizures, slowed breathing)



Clinical Investigation

Hyperthyroidism

- Increased heart rate with abnormal rhythm or pounding (palpitations)
- High blood pressure
- Increased body temperature (feeling unusually warm)
- Increased sweating
- Clamminess
- Feeling agitated or nervous
- Tremors in the hands
- Feeling of restlessness even though the person is tired or weak
- Increased appetite accompanied by weight loss
- Interrupted sleep
- Frequent bowel movements, sometimes with diarrhea
- Puffiness around the eyes, increased tears, sensitivity to light, or an intense stare
- Bone loss (osteoporosis)
- Stopped menstrual cycles

Clinical Investigation

Life-Threatening Thyrotoxicosis or Thyroid Storm



- Confusion
- Coma
- Fever
- High blood pressure
- Irregular heartbeat, which can be fatal
- Jaundice associated with liver enlargement
- Mood swings
- Muscle wasting
- Restlessness
- Shock
- Weakness

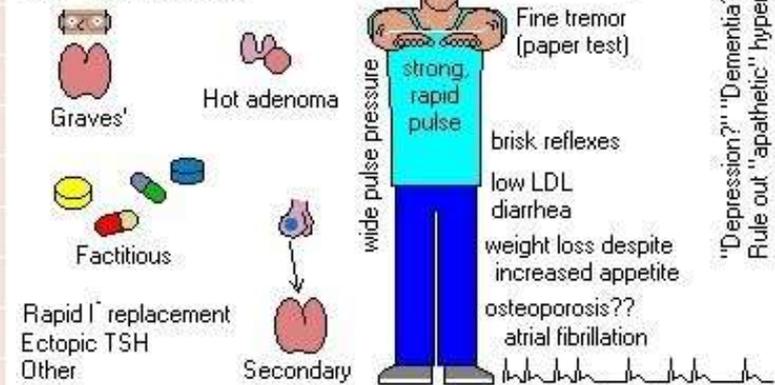
Clinical Investigation

Hyperthyroidism and Hypothyroidism in Charts

Hypothyroidism	Hyperthyroidism
Dry, coarse hair	Hair loss
Loss of eyebrow hair	Bulging eyes
Puffy face	Sweating
Enlarged thyroid (goitre)	Enlarged thyroid (goitre)
Slow heartbeat	Rapid heartbeat
Weight gain	Weight loss
Constipation	Frequent bowel movements
Brittle nails	Soft nails
	Warm, moist palms
	Tremor of fingers
Further signs and symptoms	
Arthritis	Difficulty sleeping
Cold intolerance	Heat intolerance
Depression	Nervousness
Dry skin	Irritability
Fatigue	Muscle weakness
Forgetfulness	Infertility
Heavy menstrual periods	Scant menstrual periods
Infertility	
Muscle aches	

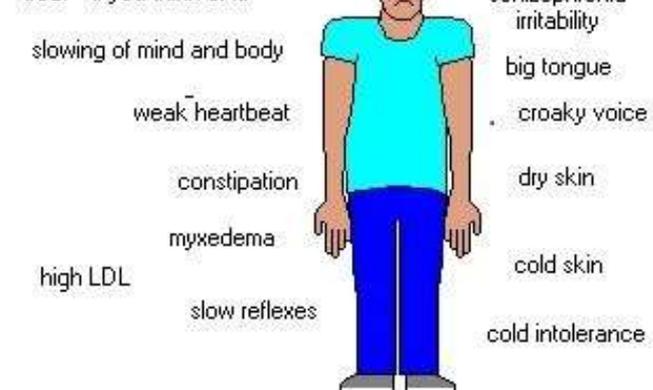
Hyperthyroidism

Easy to diagnose and treat -- if you think of it.



Hypothyroidism

Easy to diagnose and treat -- if you think of it.



Clinical Investigation

Symptoms in the Neck and Thyroid Area

- Neck discomfort
- Visible thyroid enlargement or lump
- Discomfort with ties, scarves, turtlenecks, or necklaces
- Hoarseness
- Sore throat
- Soreness in neck
- Difficulty swallowing

In some cases, thyroid diseases and conditions can have no symptoms at all, such as thyroid cancer or certain types of thyroiditis

Clinical Investigation

Nodules

- Nodules usually are found in 4-7% in the thyroid gland
- The majority of nodules do not cause any symptoms, are non-cancerous and include simple cysts, colloid nodules, and thyroid adenomas
- Malignant nodules, which only occur in about 5% of nodules, include follicular, papillary, medullary carcinomas and metastases from other sites
- Nodules are more likely in females, those who are exposed to radiation, and in those who are iodine deficient
- When a nodule is present, thyroid function tests are performed and reveal whether a person has a normal amount of thyroid hormones ("euthyroid") or an excess of hormones, usually secreted by the nodule, causing hyperthyroidism
- There can be many nodules, which is termed a multinodular goiter, and this can sometimes be a toxic multinodular goiter.

Clinical Investigation

Goiter

- Goiter which is associated with hypothyroidism or hyperthyroidism may be present with symptoms of the underlying disorder
- For hyperthyroidism, the most common symptoms are associated with adrenergic stimulation (tachycardia, palpitations, nervousness, tremor, increased blood pressure and heat intolerance), and clinical manifestations are often related to hypermetabolism (increased metabolism), excessive thyroid hormone, an increase in oxygen consumption, metabolic changes in protein metabolism, immunologic stimulation of diffuse goitre, and ocular changes (exophthalmos)
- For hypothyroidism, the most common symptoms are weight gain despite poor appetite, cold intolerance, constipation and lethargy, that are often non-specific and make diagnosis difficult.

Clinical Investigation

Goiter in Pictures



Diagnosis

Key Steps

- A clinical examination
- Blood testing: TSH test, free T4 and free T3 antibodies testing to diagnose Hashimoto's and Graves' disease, and testing for reverse T3 levels
- Imaging tests (the radioactive iodine uptake (RAI-U), computer tomography (CT) scans, magnetic resonance imaging (MRI), ultrasound) to evaluate the size, shape, and function of the thyroid gland, to evaluate the size and shape of the nodules or lumps, and evaluate whether or not they are suspicious for thyroid cancer and require further evaluation
- Fine needle aspiration biopsy (FNA) is done when thyroid nodules are considered suspicious and need to be tested for possible thyroid cancer.

Diagnosis

TSH testing of thyroid dysfunction

- The most sensitive test in an ambulatory population at risk for thyroid dysfunction is the serum TSH
- Serum TSH assays have sufficient sensitivity and specificity to identify individuals with all forms of thyroid dysfunction in the general population
- Among individuals with serious, acute illness, the serum TSH is less specific for thyroid disease because a serious illness alone can depress TSH secretion
- When an abnormal serum TSH value is obtained, the usual next step is to repeat the measurement of TSH and also measure a serum free T_4
- The most common cause of discordance between the TSH and free T_4 result occurs in patients with subclinical thyroid dysfunction with high or low serum TSH values and a normal serum free T_4 result
- Serum TSH measurements may yield misleading results for individuals with changing levels of thyroid hormones (serum TSH level may remain high for weeks in hypothyroid patients treated with T_4 , and may remain low for weeks after the serum T_4 level falls to normal in patients treated for hyperthyroidism).

Diagnosis

Hypothyroidism

- The most common cause of primary hypothyroidism is chronic autoimmune thyroiditis (Hashimoto's disease)
- Other causes are radioactive iodine and surgical therapy for hyperthyroidism or thyroid cancer, thyroid inflammatory disease, iodine deficiency, and several drugs that interfere with the synthesis or availability of thyroid hormone
- Hypothyroidism may also occur rarely (<1%) as a result of deficiency of TRH or impaired TSH secretion due to hypothalamic or pituitary disease, respectively (secondary or central hypothyroidism because of the negative feedback relationship between serum T_4 and T_3 levels and TSH secretion)
- People with primary hypothyroidism have high serum TSH levels, and the concomitant finding of a low free T_4 level confirms this diagnosis
- People with a high serum TSH concentration and a normal or low-normal serum free T_4 level have subclinical hypothyroidism
- The diagnosis of secondary hypothyroidism is based on the findings of a low serum free T_4 level and a serum TSH level that is normal or low

Diagnosis

Hyperthyroidism

- The most common cause of hyperthyroidism is Graves' disease, an autoimmune disease characterized by the production of antibodies that activate the TSH receptor, resulting in stimulation of T_4 and T_3 production and enlargement of the thyroid
- Other causes of hyperthyroidism are a multinodular goiter, solitary thyroid adenoma, thyroiditis, iodide- or drug-induced hyperthyroidism, and, very rarely, a TSH secreting pituitary tumor
- The diagnosis of hyperthyroidism is based on the findings of a high serum free T_4 level and a low serum TSH concentration
- Occasionally, patients with hyperthyroidism have a normal serum free T_4 and high serum free T_3 concentrations with normal the serum TSH (T_3 -hyperthyroidism), because of an increase in serum thyroid hormone binding protein will raise the serum total T_4 level but not free T_4 concentrations
- Patients with a low serum TSH concentration and normal serum free T_4 and free T_3 levels have subclinical hyperthyroidism.

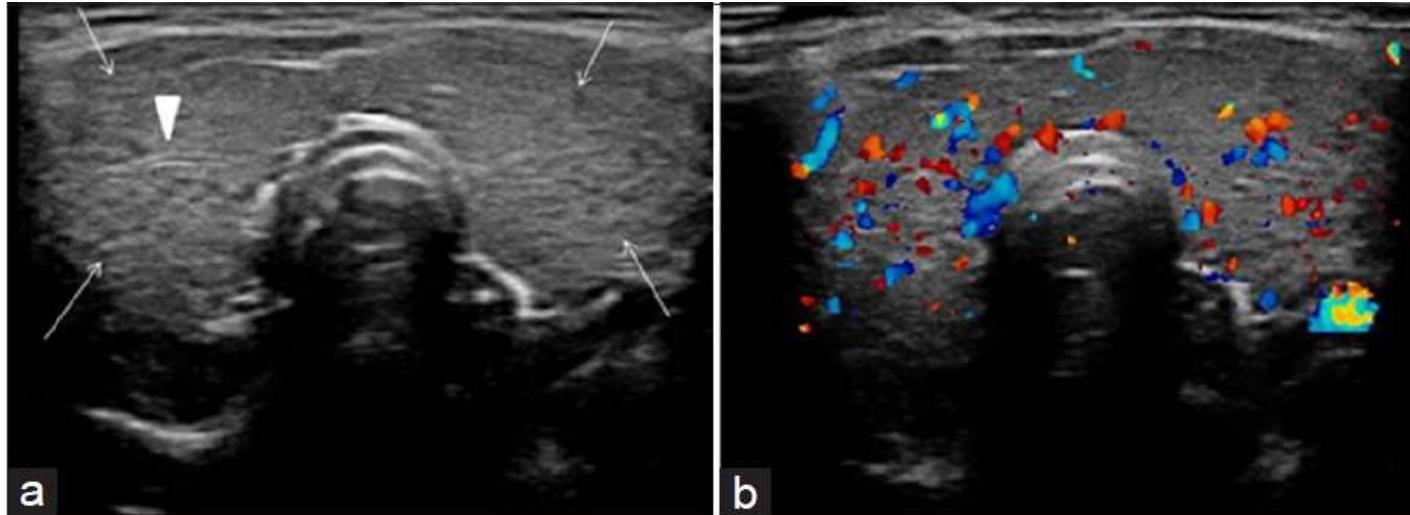
Diagnosis

Ultrasound

- Nodules of the thyroid may or may not be cancer
- Medical ultrasonography can help determine their nature because some of the characteristics of benign and malignant (irregular border, hypoechoic (less echogenic than the surrounding) tissue, microcalcifications, taller than wide shape on transverse study, significant intranodular blood flow by power Doppler) nodules differ
- Ultrasonography is not always able to separate benign from malignant nodules with complete certainty
- In suspicious cases, a tissue sample is often obtained by biopsy for microscopic examination.

Diagnosis

Ultrasound: Diffuse Hashimoto's Thyroiditis



Diffuse Hashimoto's thyroiditis in a 35-year-old female patient, who presented with features of hypothyroidism and had anti-thyroid antibodies positive for the disease.

Transverse gray-scale ultrasound neck (a) demonstrates diffuse enlargement of thyroid gland with heterogeneous echotexture. Multiple tiny and discrete hypoechoic nodules (micronodules, arrows) and few linear echogenic septae (arrowhead) are also noted. Color Doppler sonogram (b) demonstrates mildly increased parenchymal vascularity

Diagnosis

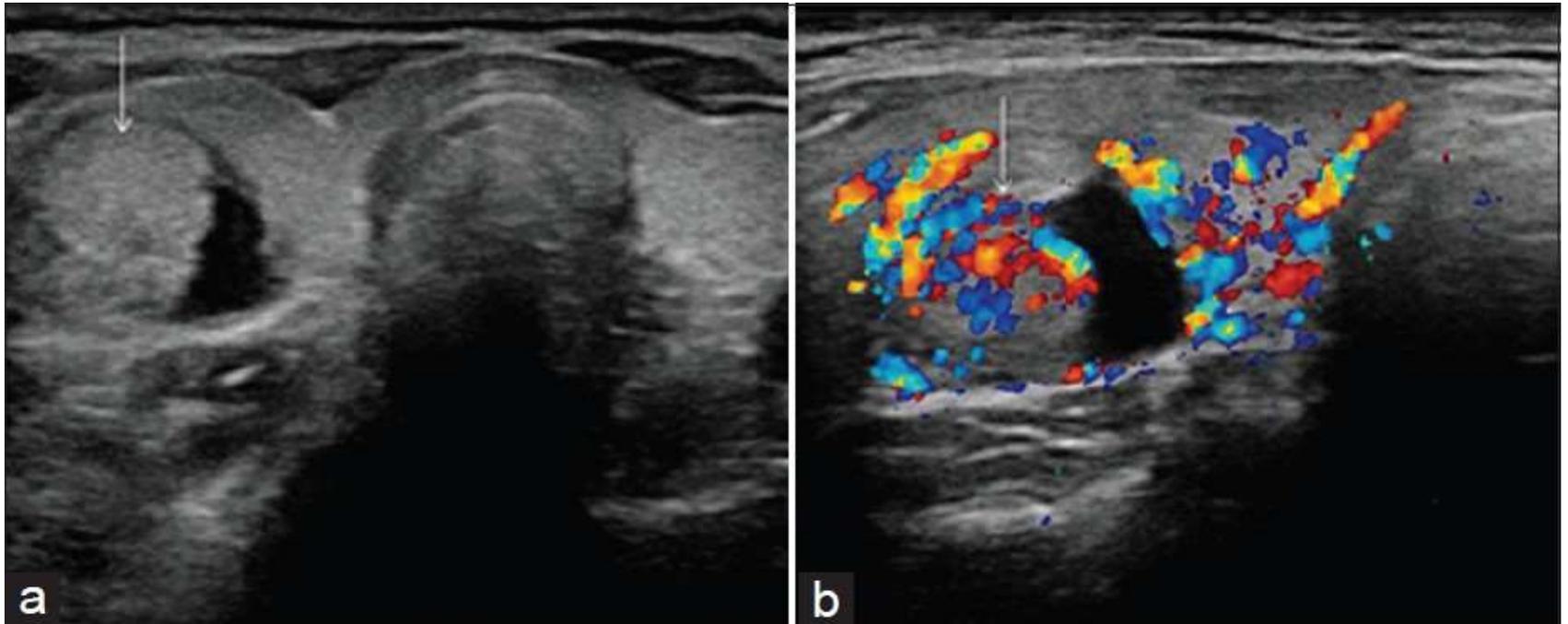
Ultrasound: Colloid Multinodular Goitre



Colloid multinodular goitre in a 50-year-old female patient. Transverse (a) and longitudinal (b) gray-scale ultrasound neck images reveal enlarged thyroid gland having multiple hyperechoic colloid nodules with internal cystic areas (arrows) showing 'ring down' sign. Color Doppler image (c) shows increased peripheral vascularity, with some intra goitrous vascularity

Diagnosis

Ultrasound: Malignant Thyroid Nodule



Malignant thyroid nodule. Hürthle cell (follicular) carcinoma in a 60-year-old woman. Transverse sonogram (a) of right lobe of the thyroid shows a partially cystic tumor with solid internal nodule (arrow) and thick walls. Color Doppler sonogram (b) depicts increased vascularity in solid parts of the tumor (arrow)

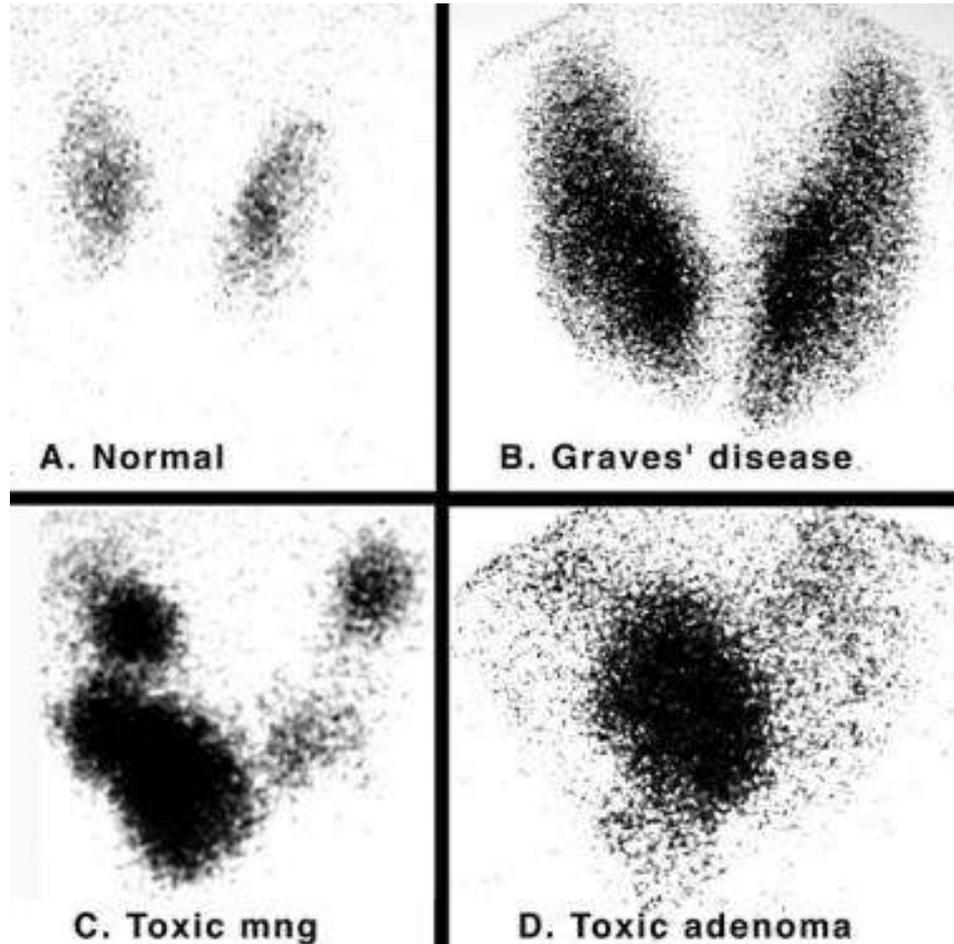
Diagnosis

Radioiodine Scanning and Uptake 1

- Thyroid scintigraphy, imaging of the thyroid with the aid of radioactive iodine, usually iodine-123 (^{123}I), is performed in the nuclear medicine department of a hospital or clinic
- Radioiodine collects in the thyroid gland before being excreted in the urine
- A nodule that is overactive ("hot") to the point of suppressing the activity of the rest of the gland is usually a thyrotoxic adenoma, a surgically curable form of hyperthyroidism that is hardly ever malignant
- Finding that a substantial section of the thyroid is inactive ("cold") may indicate an area of non-functioning tissue such as thyroid cancer
- A normal quantitation of radioiodine uptake demonstrates that about 8 to 35% of the administered dose can be detected in the thyroid 24 hours later
- Overactivity or underactivity of the gland as may occur with hypothyroidism or hyperthyroidism is usually reflected in decreased or increased radioiodine uptake

Diagnosis

Radioiodine Scanning and Uptake 2



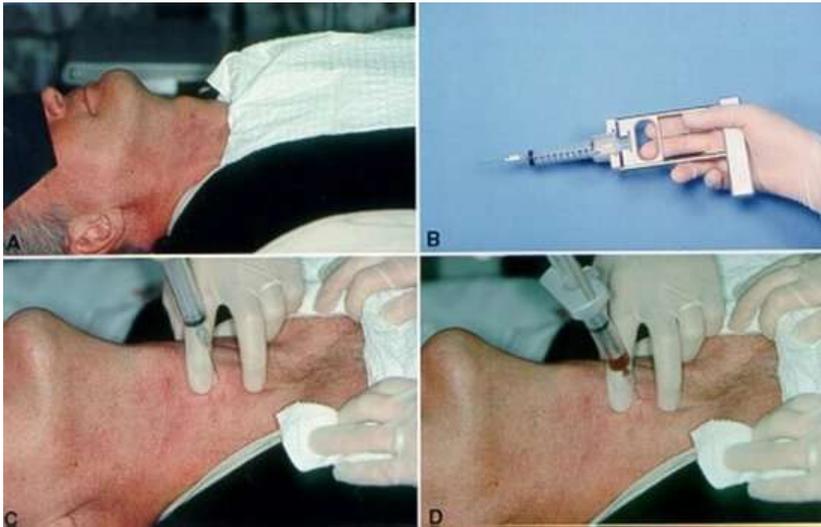
Diagnosis

Biopsy 1

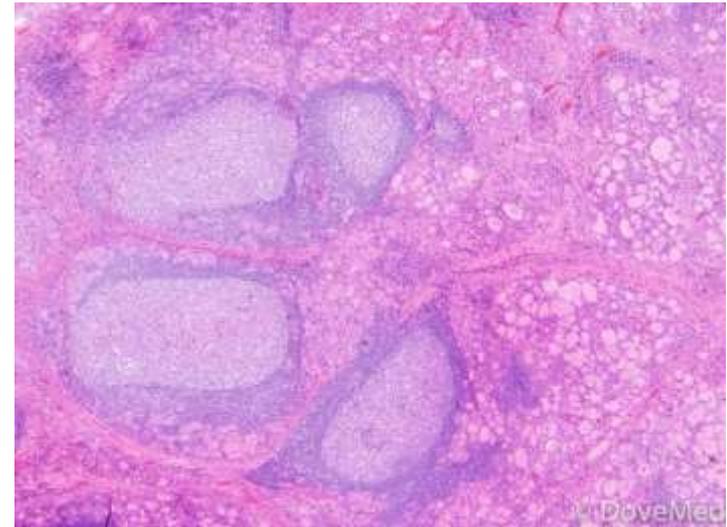
- A medical biopsy refers to the obtaining of a tissue sample for examination under the microscope or other testing, usually to distinguish cancer from noncancerous conditions
- Thyroid tissue may be obtained for biopsy by fine needle aspiration or by surgery
- Needle aspiration has the advantage of being a brief, safe, outpatient procedure that is safer and less expensive than surgery and does not leave a visible scar
- Needle biopsies became widely used in the 1980s, but it was recognized that accuracy of identification of cancer was good but not perfect
- The accuracy of the diagnosis depends on obtaining tissue from all of the suspicious areas of an abnormal thyroid gland
- The reliability of needle aspiration is increased when sampling can be guided by ultrasound, and over the last 15 years, this has become the preferred method for thyroid biopsy.

Diagnosis

Biopsy 2



Fine-Needle Aspiration Biopsy



Autoimmune Thyroiditis

Management

Key Nutrients

- Iodine deficiency is the main cause of thyroid diseases worldwide and has been considered rare in a lot of countries since the last century largely due to the widespread use of iodized salt, although supplemental iodine may cause symptom flare-ups in people with Hashimoto's disease because it stimulates autoimmune antibodies
- Vitamin D deficiency is linked to hyperthyroidism, Hashimoto's disease, and particularly Graves' disease
- The highest concentration of selenium is found in the thyroid gland, and it is necessary component of enzymes integral to thyroid function
- Vitamin B12 deficiency is the one of risk factors of autoimmune thyroid disease (ATD), so it's important for dietitians to suggest patients with thyroid disease have their levels tested

Management

Foods, Supplements, and Medication Interactions

- There are no specific foods or dietary supplements that are helpful in treating thyroid disorder
- It is important to know the medications can interact with common nutritional supplements
- Calcium supplements have the potential to interfere with proper absorption of thyroid medications, so patients must consider the timing when taking both
- Coffee and fiber supplements lower the absorption of thyroid medication, so patients should take them one hour apart
- Chromium picolinate, which is marketed for blood sugar control and weight loss, also impairs the absorption of thyroid medications and patients should take it three to four hours apart from thyroid medications
- Flavonoids in fruits, vegetables, and tea may suppress thyroid function
- The Natural Standards Database provides an extensive list of supplements that have a potential impact on thyroid function, so taking precautions and coordinating patient care with a knowledgeable practitioner is prudent.

Management

Goitrogens

- Cruciferous vegetables such as broccoli, cauliflower, and cabbage naturally release a compound called goitrin when they're hydrolyzed, or broken down
- Goitrin can interfere with the synthesis of thyroid hormones, however, this is usually a concern only when coupled with an iodine deficiency
- Heating cruciferous vegetables denatures much or all of this potential goitrogenic effect
- Soy is another potential goitrogen, and the isoflavones in soy can lower thyroid hormone synthesis
- The potential exception is millet, a nutritious gluten-free grain, which may suppress thyroid function even in people with adequate iodine intake

Management Exercise

- With hypothyroid patients, exercise can help with weight gain, fatigue, and depression
- With hyperthyroidism, anxiety and sleep disturbances are so common, and exercise can help regulate both
- In addition to the obvious impact exercise has on weight and metabolism, a study of patients with Graves' disease found that
- A structured exercise program in patients with Graves' disease is showing dramatic improvements in fatigue levels, and significantly more patients are able to successfully stop taking antithyroid medications without a relapse
- Since fatigue can be a barrier to exercise, it is recommended patients use a pedometer as a tool for a tangible source of structure and motivation.

Management Hypothyroidism

- Hypothyroidism is treated with thyroid hormone replacement drugs
- The most commonly prescribed thyroid hormone replacement drug is known generically as levothyroxine, a synthetic form of the thyroid hormone thyroxine
- There is also a synthetic form of the T3 hormone, known as liothyronine, that is sometimes added to levothyroxine for T4/T3 combination treatment
- There is a hormone replacement drug called natural desiccated thyroid (NDT) or thyroid extract; while it has been available for more than a century and is still in use today.

Management

Hyperthyroidism and Graves' Disease

- There are three key ways that chronic hyperthyroidism and Graves' disease are treated
- Antithyroid drugs (methimazole, carbimazole and propylthiouracil) treatment, that can slow down the thyroid's production of thyroid hormone
- Radioactive iodine treatment (RAI), that given in a single dose, either in a capsule or drink; this shrinks the thyroid, slows down its function, and reverses hyperthyroidism
- Thyroid surgery/thyroidectomy in some cases, especially for patients who cannot tolerate antithyroid drugs or are pregnant and RAI is not an option.

Management Goiter

- Goitre is treated according to the cause
- If the thyroid gland is producing too much T3 and T4, radioactive iodine is given to the patient to shrink the gland
- If goitre is caused by iodine deficiency, small doses of iodide in the form of Lugol's Iodine or KI solution are given
- If the goitre is associated with an underactive thyroid, thyroid supplements are used as treatment
- In extreme cases, a partial or complete thyroidectomy is required.

Management Thyroid Cancer

- Treatment for thyroid cancer almost always involves surgical removal of the thyroid gland
- For more aggressive types of thyroid cancer, this may be followed by RAI treatment to ensure that all thyroid cells are destroyed, a process known as remnant ablation
- Following surgical removal of the thyroid gland, patients are functionally hypothyroid and require lifelong thyroid hormone replacement treatment
- Less commonly, other treatments, including external beam radiation, chemotherapy, radiofrequency ablation, and percutaneous ethanol injections.

Management

Autoimmunity and Hashimoto's

- Integrative and functional medicine practitioners sometimes treat autoimmune thyroid disease, especially Hashimoto's, with the drug low dose naltrexone (LDN) which may help lower antibodies
- Other treatment approaches include:
 - Supplementation with selenium to lower antibodies
 - Addressing related adrenal imbalances that may be complicating thyroid treatment
 - Dietary changes to reduce inflammation
 - Eliminating gluten from the diet due to a connection between gluten and autoimmunity
 - Stress reduction and management.

Prognosis

- Most people with either hypothyroidism, hyperthyroidism, and benign and malignant thyroid nodules, with proper diagnosis and treatment, can control their condition with no long-term effects and a normal life expectancy
- Those with undiagnosed disease may progress to hypothyroid coma or thyrotoxic crisis (thyroid storm), with death rates approaching 50%
- Graves' eye disease has been treated with corticosteroid medication, radiotherapy, and surgery with varying success
- Patients with thyroid cancer have a very low mortality rate (<5%) but the overall risk depends on age, type of thyroid cancer, and the extent of spread of the tumor
- Endocrinologists will manage the evaluation and treatment of thyroid cancer, rather than an oncologist.

Prophylaxis

- There is no known way to prevent hyperthyroidism or hypothyroidism
- In some countries, iodine deficiency is rare, so there is no way to prevent goiter or thyroid nodules
- Anyway, Iodide is essential for thyroid hormone synthesis, and the World Health Organization (WHO) recommends: 90 mcg of iodine daily for infants and children up to five years; 120 mcg for children 6 to 12 years; 150 mcg daily for children ≥ 12 years and adults; 250 mcg daily during pregnancy and lactation
- Radiation will induce both benign and malignant thyroid nodules, so individuals should avoid excess radiation or unnecessary CT scans of the head and neck and use a "thyroid shield" when dental X-rays are performed

Abbreviations

ATD - autoimmune thyroid disease

CT - computer tomography

FNA - fine needle aspiration biopsy

Free T4 - free thyroxine

Free T3 - free triiodothyronine

LDN - low dose naltrexone

MRI - magnetic resonance imaging

NDT - natural desiccated thyroid

RAI - radioactive iodine treatment

RAI-U - the radioactive iodine uptake

TSH - thyroid stimulating hormone

Diagnostic and treatment guidelines

- [American Thyroid Association Professional Guidelines](#)
- [European Thyroid Association Guidelines](#)