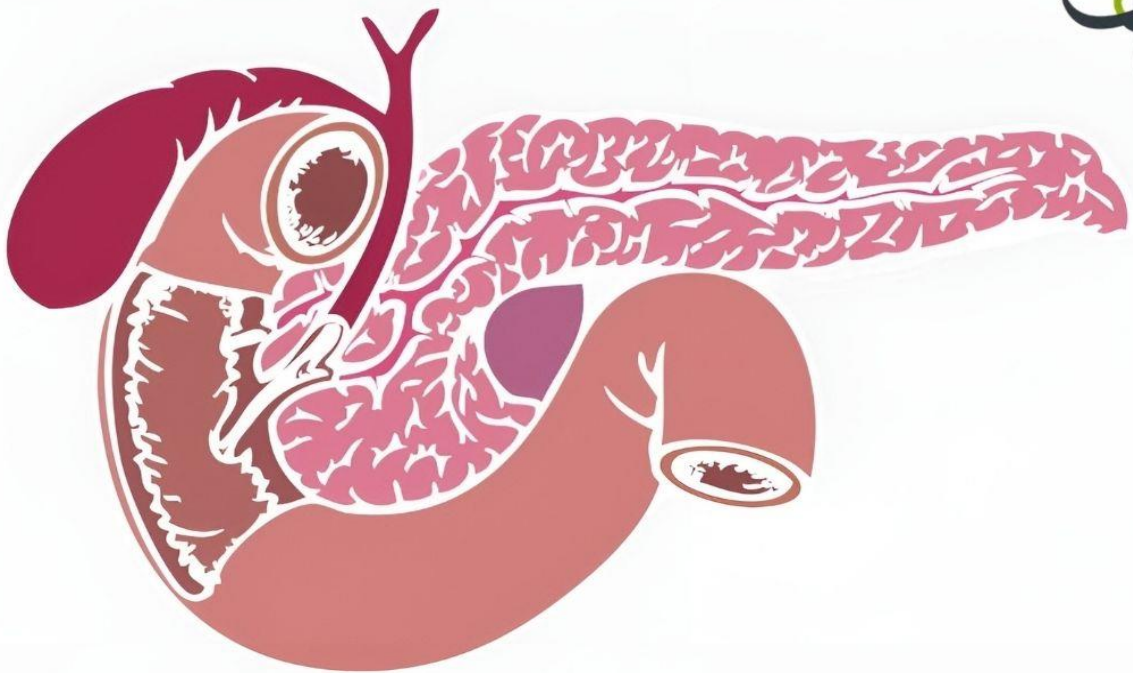


Endocrine system

1

Pathology



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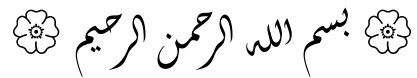
Some notes:

[Click](#) to reach the recommended videos that the doctor sent.

Slides info are in **pink**

Doctor explanation is in **black**

All the discussed examples are written



Endocrine system is a system where small amount of chemicals are excreted from certain organs, transferred through blood to work on another organ.

Hormone (محفز): ex. Hormone is excreted from the pituitary gland (TSH) → through the blood stream → stimulate the thyroid to produce T3, T4.

Endocrine system is divided to Autocrine, and Paracrine as explained [here](#) ♥.

🌀 General concepts of endocrine system:

❖ Basics of hormone physiology:

These hormones –which are proteins/chemicals- work by binding to a receptor -which could be found on the surface, or in the cytoplasm, or even in the nucleus of the targeted cells-, stimulating the machinery protein synthesis.

- Cell surface receptor binding hormones (GH).
- Intracellular receptor binding hormones (ER).

❖ Feedback inhibition

- This is a characteristic for the endocrine system.

Let's explain it using the previously mentioned example:

The pituitary gland secretes TSH hormone which reaches the thyroid gland through the blood supply stimulating it to secrete T3, T4 hormones, these two hormones will work as a feedback inhibiting hormones by inhibiting the production of TSH from the pituitary gland.

When a problem happens in this system (feedback inhibition or stimulation) it will cause a disease (hyperfunction or hypofunction) which are the main problems in the endocrine system.

❖ Laboratory chemical testing

(This is a hot topic for questions in the exams in the future 😊)

When a patient comes to the clinic complaining from signs and symptoms related to thyroid hyperfunction, you need to make **T3, T4, TSH** routine to understand the etiology of the disease.

❖ **Pathology of the endocrine glands**

- **Hyper or hypo production**

Hyper → Ex. hyperthyroidism, hyperparathyroidism, hyperpituitarism.

Hypo → Ex. primary hypothyroidism:

The thyroid is damaged by Hashimoto thyroiditis causing inflammation that lead to completely sclerosed fibrostatic gland, and so loss of T3, T4 secretion.

- **End organ resistance**

The secreting organ is normal but the peripheral cells are not responding to the secreted hormone.

Ex. Diabetes type II

The pancreas is normal but the peripheral tissue cells are not responding to the insulin produced by β langerhan cells of the pancreas.

This is very complicated because it is sometimes related to the receptor, or the glycosylation...

- **Neoplasms (functional or nonfunctional)**

Neoplasm = tumor ...which are sometimes:

Functional → Ex. cortical adenoma of the adrenal gland –which secrets adrenocortical hormones, cortisol...-

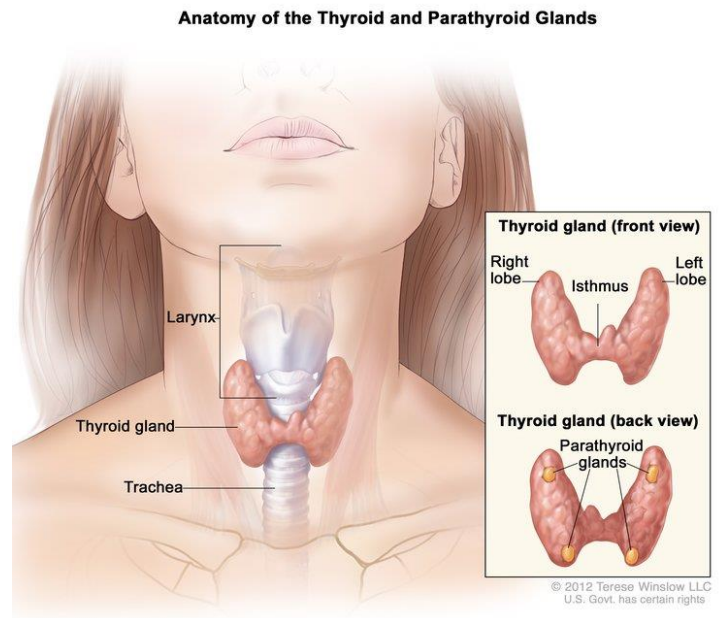
Nonfunctional → Ex. pituitary adenomas.

More than 50% are nonfunctional causing pressure symptoms around the structures, (but without prolactin getting out from the lipids).

The functional pituitary adenoma presents faster, because the released hormones will stimulate the REG so the patient will complain from symptoms and signs related to hyperfunctioning gland.

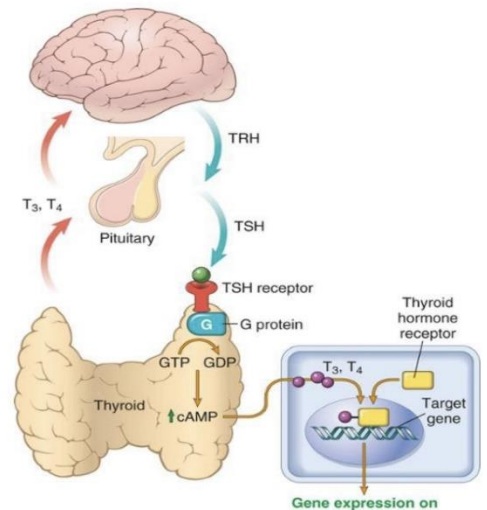
☼ Anatomy of the thyroid

- Found in the neck
 - Composed of right and left lobes
 - The lobes are connected by the isthmus
 - Have a butterfly shape
 - From the posterior view, you will find 4 small parathyroid glands (upper right, lower right, upper left, lower left).
 - Usually the surgical pathology is related to parathyroid glands.
 - It is difficult to identify the parathyroid glands in surgery
 - Ex. A patient with hypercalcemia→ the doctor's diagnosis was parathyroid adenoma or parathyroid hyperplasia→ the doctor decided a surgery to remove the enlarged parathyroid to prevent continuous hypercalcemia→ when the doctor removed the enlarged part he send it to the pathologist to make a frozen section (to ensure that the problem –hypercalcemia- is from this the enlarged part and to ensure that the removed part is not a normal lymph node or accessory thyroid tissue).
- In chronic renal failure patients→ if hyperplasia: sometimes the doctor remove the 4 parathyroid glands, (then half one will be implanted under the skin).



Thyroid releasing hormone (TRH) is released from the cortex of the brain reaching the anterior pituitary gland → release thyroid stimulating hormone (TSH) → bind to G protein coupled receptor on the thyroid gland → causing T3, T4 production.

(T3, T4 make feedback inhibition for TRH, TSH).



☼ Thyroid disorders

- **Very common diseases.**
- Hypo and hyperthyroidism
- **Thyroiditis (autoimmune and others):**
Inflammation in the thyroid
Hashimoto thyroiditis (named after the Japanese doctor Hashimoto) very common, it starts as hyperthyroidism → **euthyroid** → hypothyroidism.
- **Enlargement (diffuse and multinodular goiter MNG):**
Goiter: means enlargement of the thyroid –usually in middle aged females– which is the **most common disease of the thyroid**.
♣The multinodular is more common than diffuse, with no function in the thyroid (nor hyperthyroidism either hypothyroidism), and more common in females.♣
So the most common disease is multinodular nonfunctional goiter.
- Neoplasms

🌸 Hyperthyroidism/ Thyrotoxicosis

Some people don't recommend using these two terms interchangeably because:

Hyperthyroidism → mild hyperthyroidism

Thyrotoxicosis → severe hyperthyroidism

🌸 But for us it's the same 🌸

It is known by the elevation of **T3, T4 serum level**, and the **decrease of TSH**.

(Because of the negative feedback mechanism)

The symptoms of hyperthyroidism are the same for **fight & fright**. (Sweating, palpitation, tachycardia).

So every cell in our body will be affected by the increase of T3, T4. (Hyper metabolic hormones)

This will let the patient arrive to the hospital within a week because of:

- ↓ sleeping
- ↑ appetite
- Weight loss
- Sweating
- Menstrual cycle abnormality in females
- Tachycardia

And all the symptoms in the pic.

It is called **primary hyperthyroidism (most common)** because the problem is in the same organ not in another one, meaning that the problem -which is the increase in T3, T4 concentration- affects the thyroid -which is the organ that secret them-.

Signs and Symptoms of Hyperthyroidism



🌸 Associated with Hyperthyroidism

Associated With Hyperthyroidism	
Primary	
Diffuse toxic hyperplasia (Graves disease)	
Hyperfunctioning ("toxic") multinodular goiter	
Hyperfunctioning ("toxic") adenoma	
Iodine-induced hyperthyroidism	
Secondary	
TSH-secreting pituitary adenoma (rare)*	(High TSH)
Not Associated With Hyperthyroidism	
Granulomatous (de Quervain) thyroiditis	(painful)
Subacute lymphocytic thyroiditis	(painless)
Struma ovarii (ovarian teratoma with thyroid)	
Factitious thyrotoxicosis (exogenous thyroxine intake)	

🌸 Very
important
table 🌸

Explanation for the table above:

PRIMARY is associated with:

- ❖ **Diffuse toxic hyperplasia:** the whole gland is hyperplastic (increase in 1-number of cells, 2-function). So all the gland follicles are hyperfunctioning not a single area.

(For the treatment you need to remove the whole thyroid, -not like the toxic adenoma in which you can remove the affected part only-, because the patient can't live without T3, T4, and if the whole thyroid is removed you will need thyroid replacement therapy).

What is Graves disease?????

It is primary diffused toxic thyrotoxicosis. (not really common disease)

- ❖ **Hyperfunctioning ("toxic") multinodular goiter:**
Less common than nonfunctioning multinodular goiter.
The presence of **non-neoplastic multinodular** goiter is much more common than neoplastic. (benign diseases are much much more common than malignant)
- ❖ **Hyperfunctioning ("toxic") adenoma:**
Functioning benign adenoma of the thyroid.

In a patient with 1.5 cm sized adenoma in the right upper lobe of the thyroid, we use radiology tests like iodine uptake test to ensure that the case is hyperfunctioning adenoma.

- ❖ **Iodine-induced hyperthyroidism.**
Was common early (because of deficiency in iodine), but now all the table salts (ملح الطعام) are iodinated to prevent thyroid disease.

📌 **Note from the 2nd lecture:**

When you start taking iodine it will cause hyperthyroidism, but after a while because of the negative feedback the result will be hypothyroidism.

SECONDARY is associated with:

- ❖ **TSH-secreting pituitary adenoma** (*which is very rare*)
In this case we find **↑TSH and ↑T3, ↑T4**.
The T3, T4 are high not because of a problem in the thyroid, but because there is high TSH concentration coming from the **pituitary adenoma**.

So High TSH indicates **TSH-secreting pituitary adenoma** or **TRH pituitary lobe abnormality**.

The most sensitive test for hyperthyroidism is **TSH**.

But usually for patients that you are suspecting hyperthyroid or hypothyroid you need to do T3, T4, TSH tests.

NON-ASSOCIATED WITH HYPERTHYROIDISM:

De Quervain is
French

❖ **Granulomatous (de Quervain) thyroiditis (painful):**

Granulomas with the thyroid, painful, not as common as the others.

❖ **Subacute lymphocytic thyroiditis (painless):**

Some people say that there is no difference between subacute lymphocytic thyroiditis and lymphocytic thyroiditis which is part of hashimoto thyroiditis. ☁ Hashimoto thyroiditis is inflammation of the thyroid by lymphocyte.

❖ **Struma ovarii (ovarian teratoma with thyroid):**

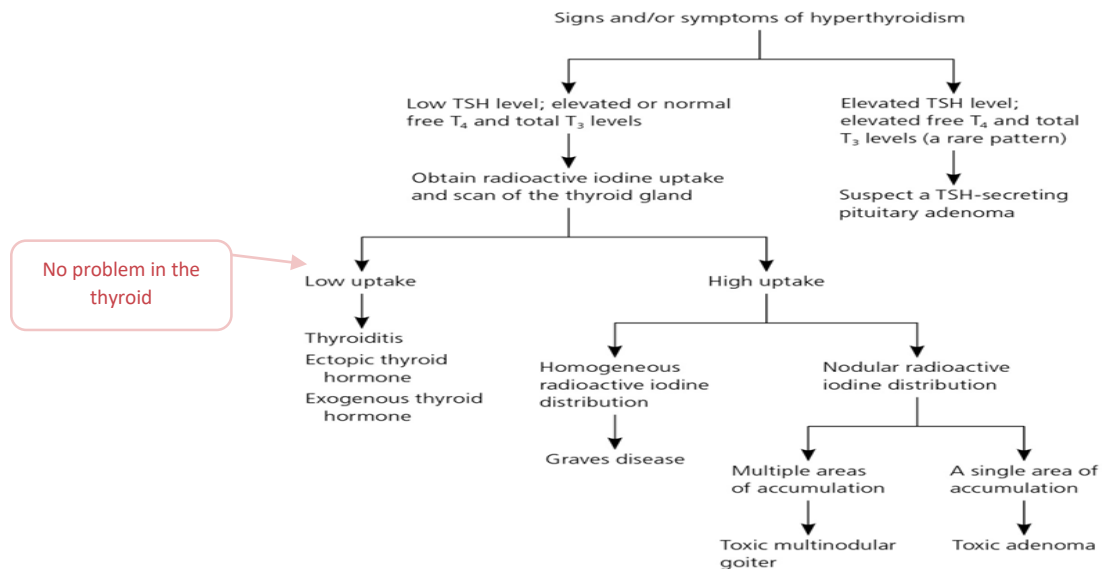
Remember that teratoma (germ cell tumor) is a sac filled with mature teeth, hair, bones...

Here the teratoma contains thyroid gland.

Sometimes it causes papillary thyroid carcinoma in the ovary, or anaplastic carcinoma in the ovary, (rare to be functioning) **common exam question**☺

❖ **Factitious thyrotoxicosis (exogenous thyroxine intake)**

For example: when a patient suffers from hypothyroiditis (which is related to end stage hashimotos, or iatrogenic hypothyroidism) you need to give him thyroid replacement therapy -to avoid the symptoms associated with hypothyroidism-, but sometimes the given dose is higher than needed so it leads to hyperthyroidism.



This is **exophthalmos**, which is an indicator for Graves disease (severe hyperthyroidism), it has a specific pathophysiology that we will take later.

(When the eye is opened you will notice that the sclera is more prominent below the pupil).



✿ Some questions that the doctor asked at the end of the lecture

- ❖ What is the most common disease of the thyroid???
- Multinodular goiter**
- ❖ Which is more common; functioning or nonfunctioning multinodular goiter?
- Most of the thyroid diseases are euthyroid (T₃, T₄ levels are normal).**
- ❖ What is more common euthyroid diseases or hyperthyroid/hypothyroid diseases???
- Euthyroid diseases**
- ❖ The most common neoplasm in female genital tract is???
- Fibroid (leiomyoma)**
- ❖ The most common *malignant neoplasm* in female genital tract is???
- Endometrial adenocarcinoma**

The end