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Welcome to our second presentation on the ENDOCRINE SYSTEM. In the first part we covered the pancreas, the pituitary gland and the pineal gland. In this second part we will be talking about:

1) The THYROID GLAND
2) The PARATHYROID GLANDS
3) The ADRENAL GLANDS

We will not be covering Ovaries and Testicles here. The ovaries and testicles and their hormones have already been covered in the presentations on the Reproductive System.

So now let's continue to cover the endocrine system starting with the:

**THYROID GLAND**

The thyroid is located in the front of the neck. This gland consists of a right and a left lobe. The thyroid REGULATES METABOLISM and CALCIUM in the body by secreting the following hormones:

1) **T3 and T4:** Iodine is necessary to make T3 and T4 reason why it is supplemented in salt known as “iodized salt”. These hormones also REGULATE GROWTH, and the development of the bones BONE DEVELOPMENT (making bones hard), the development of the nervous system NERVOUS SYSTEM DEVELOPMENT. For these reasons the thyroid hormones are especially important in newborns so they grow into a smart, strong, healthy kids.

   They also increase the body's metabolism promoting the breakdown of protein, fat and carbs This is known as a CATABOLIC EFFECT. Some hormones, like insulin, have the opposite effect promoting the storage of proteins, fat or carbs. This is known as an ANABOLIC EFFECT. T4 is called THYROXINE. Another hormone made by the thyroid is called:

2) **CALCITONIN:** it works by lowering blood calcium levels.

Now, when the thyroid gland gets sick it can either go nuts and secrete too much of its hormones or get lazy and not make enough hormones. When it makes too much hormones, in other words, when the thyroid's function is HIGH we get what doctors call:

1) **HYPERTHYROIDISM:** this means that there are too much thyroid hormones being made and this causes the body's metabolism to speed up!

   **CAUSES:** Hyperthyroidism can be caused by

   • **GRAVES DISEASE:** a disorder where the body produces antibodies that stimulate the gland, whipping up its hormone production.
• Hyperthyroidism can also be caused by a tumor in the gland called a **TOXIC ADENOMA**, which secretes excess thyroid hormone (just to clarify that the word “toxic” here is not used in the sense of “poison” but in the sense of “makes too much hormone”)

**SOME SIGNS OF HYPERTHYROIDISM:**
• TREMBLING
• DIARRHEA
• WEIGHT LOSS
• IRREGULAR MENSES
• NERVOUSNESS
• MOIST SKIN
• QUICK PULSE (aka TACHYCARDIA).
• GOITER
• BULGING EYES

**DIAGNOSIS:** blood tests like: **THYROID FUNCTION TESTS** (aka “thyroid panel”) measure levels of TSH, T3, T4 is useful to diagnose hyperthyroidism

**TREATMENT:** hyperthyroidism can be treated through the use of:
• **RADIOIODINE:** Which is a radioactive isotope of iodine. The thyroid gland loves iodine or anything that contains iodine so it takes in all the radioiodine which shuts the gland down partially (sort of like sending the thyroid on a trip to Chernobyl). The idea here is that shutting down some of the gland will reduce the amount of thyroid hormones being made, thus normalizing the gland’s function.

Other treatment options are:
• **ANTITHYROID DRUGS:** like METHIMAZOLE
• **BETA-BLOCKERS:** to reduce symptoms like tremors and the accelerated heart rate and
• **SURGERY:** what's known as a **THYROIDECTOMY** is done to remove gland, partially or totally. Less gland...less hormones secreted.

When the thyroid's function is **LOW** we get what the doctors call:

2) **HYPOTHYROIDISM:** which means that the thyroid is not making enough hormone. **Metabolism slows** down!

**CAUSES:** Hypothyroidism can be caused by
• **HASHIMOTO'S DISEASE** which is a disorder where antibodies against the gland appear destroying it.
Hypothyroidism can also result when treating Hyperthyroidism!
• **THYROIDECTOMY** when too much gland is removed or after the use of
• **RADIOIODINE** in the course of treating hyperthyroidism when too much of the gland is shut down.
• When hypothyroidism is caused by a lack of dietary iodine it's known as: **ENDEMIC GOITER** and endemic means native to because it only occurs in certain places where there is not enough iodine. A goiter is the enlargement of the thyroid.
SOME SIGNS OF HYPOTHYROIDISM:

- GOITER
- INTOLERANCE TO COLD
- FATIGUE
- CONSTIPATION
- WEIGHT GAIN
- IRREGULAR MENSES
- DEPRESSION
- HOARSENESS
- DRY SKIN
- SLOW PULSE.

DIAGNOSIS: THYROID PANEL is also used to diagnose hypothyroidism.

TREATMENT: is based on giving the patients what they lack which is thyroid hormone **LEVOTHYROXINE** (which is the synthetic version of T4) is prescribed.

3) **THYROID CANCER**: is a malignant tumor of the gland.

SOME SIGNS OF THYROID CANCER: If the cancer produces a lot of hormones then the symptoms will be those of

- **HYPERTHYROIDISM**. At other times patient only notices a
- **LUMP** in the gland or they may come in complaining of
- **HOARSENESS** due to tumor invading the **recurrent laryngeal nerve** which paralyzes the vocal chords causing the hoarseness.

**DIAGNOSIS:**

- THYROID ULTRASOUND and
- FINE NEEDLE ASPIRATION Is used to diagnose thyroid cancer and it's treated through:

**TREATMENT: RADIATION OR SURGERY**

When the thyroid gland becomes inflamed we get:

4) **THYROIDITIS**: it can be caused by a virus

- **VIRAL**
- **DRUG-INDUCED**: there is a drug used by cardiologists called **AMIODARONE** which has a tendency to inflame the thyroid.
- **HASHIMOTO'S**: can also cause it

**SOME SIGNS OF THYROIDITIS**:

- GOITER which may be tender (sore), and there may be
- FLU-LIKE SYMPTOMS if it's caused by a virus.

**DIAGNOSIS**: there are blood tests which are useful to diagnose thyroiditis like:

- **THYROID FUNCTION TEST**
- **RADIOACTIVE IODINE UPTAKE (RAIU) aka THYROID SCAN**: in this test the
patient is given **radioiodine by mouth** which is absorbed by the gland and acts as a tracer. The patient later returns to get a **scan** of their thyroid to determine how much of the tracer was absorbed by the gland. Uptake is low in thyroiditis.

**TREATMENT:**

- **BETA-BLOCKERS** are given *if there are symptoms of hyperthyroidism* like trembling or accelerated pulse
- **LEVOTHYROXINE**: *if there are symptoms of hypothyroidism and*
- Non-Steroidal Anti-inflammatory drugs **NSAIDS**: like **IBUPROFEN** prescribed if gland is sore.

When we come across an enlarged thyroid gland we are in the presence of a:

5) **GOITER**: and just to be clear, goiter is a term that only means **enlargement of the gland**. It does not tell us however if the gland's function is high or low since goiters can appear in both hyper and hypothyroidism. It definitely means that something's not right!

**PARATHYROID GLANDS**

In number of 4, these tiny glands, are located in the back of the thyroid gland and secrete **PARATHYROID HORMONE (PTH)**. You can call them the “calcium glands” if you like because their job is to **retain calcium**. They also regulate the balance of **phosphorus**.

So, talking about problems with the parathyroids basically means talking about calcium problems as PTH retains calcium.

When there is **too much PTH** being secreted that's called:

1) **HYPERPARATHYROIDISM**

**CAUSES**: it can be triggered by
- a **PARATHYROID TUMOR** which secretes excess PTH or
- indirectly by **KIDNEY DISEASE** because **vitamin D acts increasing blood calcium but needs to be “activated” by the kidneys to do so.** So **when the kidneys get sick, vitamin D is not activated** and calcium levels drop. This signals the parathyroids to start secreting excess PTH to try and normalize the blood calcium level. This comes at an expense since **PTH borrows the calcium from the bones** which **weakens the bones**.

**SOME SIGNS OF HYPERPARATHYROIDISM**: Hyperparathyroidism is generally
- **ASYMPTOMATIC**
  or presents with non-specific symptoms like:
- **FATIGUE**-refers to a constant feeling of being very tired
- **DEPRESSION,**
- **NAUSEA, VOMITING and ABDOMINAL PAIN**
- **BONE PAIN**
**DIAGNOSIS** : blood tests to measure **CALCIUM** and **PTH LEVELS**

**TREATMENT** :
- **SURGICAL** removal of tumor or
- **DIURETICS** and/or
- **DIALYSIS** to try to flush out the calcium if it is caused by kidney failure.

On the other hand when there is too little **PTH** being secreted we have:

2) **HYPOPARATHYROIDISM = LOW BLOOD CALCIUM** : Here the lack of PTH results in **low calcium** levels in blood.

**CAUSES**: Hypoparathyroidism is generally **IATROGENIC**, caused by **injury** to the parathyroid glands **during thyroid surgery**.

**SOME SIGNS OF HYPOPARATHYROIDISM**:
- **MUSCLE TWITCHING** or **MUSCLE SPASM**
- **ABDOMINAL CRAMPS** and
- **TINGLING** around mouth, and in hands and feet.

**TREATMENT**: Since what is missing is calcium it is then only logical to treat it with **CALCIUM SUPPLEMENTS**.

Now, let's go on to the “**the stress glands**”. We sure do use these a lot in our everyday lives.

They are the **ADRENAL GLANDS**

The adrenals are two small glands located atop each kidney- reason why they are **aka** the **SUPRARENALS**. These little glands have big obligations as they are in charge of **regulating body salt and water**. They are another one of our centaurs since they are part gland, part nervous tissue.

- The outer part of the adrenal gland called the **CORTEX** is glandular tissue.
- The central part called the **MEDULLA** is made of nervous tissue.

The cortex and medulla do **different things**. The cortex secretes hormones called **CORTICOSTEROIDS** and there are 2 main types of corticosteroids: the mineralocorticoids and the glucocorticoids.

- The **MINERALOCORTICOIDS** : regulate the balance of
  - **MINERAL SALTS** aka **ELECTROLYTES** and
  - **WATER** in the body.

Mineralocorticoids tell the **kidney to retain sodium and water**! **ALDOSTERONE** is the principal mineralocorticoid in the body.
The second type of corticosteroids are the:

- **GLUCOCORTICOIDS** (aka “stress hormones”) To understand why they call them “stress hormones” first it is necessary to talk about what's known as the **“FIGHT OR FLIGHT” RESPONSE**. When danger appears glucocorticoids are secreted. If you were in front of a potential enemy you would size him up and decide if you'll stay to fight or run for the hills! Either way, you will need to use your muscles a lot and your muscles need fuel. And what's the basic cell fuel ?? That's glucose. So glucocorticoids-as their name implies:
  --INCREASE BLOOD SUGAR and have an
  --ANTI-INFLAMMATORY EFFECT

  When we think about glucocorticoids we think about **CORTISOL aka HYDROCORTISONE**. Glucocorticoids are commonly referred to as: “cortisone”.

Now that we've talked about the hormones produced by the adrenal cortex, let's see what the **MEDULLA** does. The adrenal medulla secretes hormones called **CATECHOLAMINES**. Like glucocorticoids, catecholamines are also “stress hormones” and are secreted in great quantity during the “fight or flight” response we mentioned before. When we think about catecholamines we think about **ADRENALINE** and **NORADRENALINE**. Catecholamines are the ones who produce those unpleasant sensations that you feel when you get into a heated discussion with someone or when you slam on the brakes of your car to avoid an accident. In these instances we all notice a:

- **QUICK PULSE**
- **NERVOUSNESS**
- **HIGH BLOOD PRESSURE**

**SOME DISEASES:**

- When there are too much corticosteroids in blood we get what's known as: 1) **HYPERCORTICISM or CUSHING'S SYNDROME** (Cushing, by the way is the last name of the neurosurgeon who discovered this condition). Cushing's Syndrome is a group of signs and symptoms that appear when there's too much glucocorticoids in blood.

  **CUSHING'S SYNDROME--> HIGH GLUCOCORTICOIDS LEVELS**

**CAUSES**

- It's generally seen in patients under treatment for a condition which requires prolonged use of synthetic glucocorticoids like **PREDNISONE** or **METHYLPREDNISOLONE** (and when a patient develops a disease or is injured as a result of a medical treatment this is known as **IATROGENESIS**).
- Excess glucocorticoids can be also due to the presence of a tumor somewhere, generally in the hypophysis, an **ADENOMA** that secretes **ACTH** which, if we remember from Endocrine System part 1, we had said that **ACTH was a pituitary hormone that stimulates corticosteroid secretion**. When the syndrome is due to a tumor they call it **CUSHING'S DISEASE**.
SOME SIGNS OF CUSHINGS SYNDROME are:

• HIGH BLOOD PRESSURE
• OBESITY
• HIRSUTISM (means woman with facial hair),
• HUNCH BACK
• FAT FACE

Other symptoms are:

• DEPRESSION
• OLIGOMENORRHEA
• DIABETES SYMPTOMS (remember glucocorticoids raise blood sugar).

DIAGNOSIS:

• a 24-HOUR URINARY CORTISOL TEST
• DEXAMETHASONE TEST

are useful to diagnose Cushing's Syndrome.

TREATMENT:

• If caused by a tumor (pituitary adenoma) then SURGERY and RADIOTHERAPY are used to treat Cushing's Disease.
• The drug KETOCONAZOLE which is usually used to treat fungal infections is useful because it also blocks production of corticosteroids

On the other end of the spectrum we have:

2) ADRENAL INSUFFICIENCY aka ADDISON'S DISEASE : which is due to a deficit of mineralocorticoids in blood

ADDITION'S DISEASE--> LOW MINERALOCORTICOID LEVELS

Due to failure of the adrenal cortex. Addison's can become a LIFE-THREATENING DISEASE and may be caused by:

• AUTOIMMUNE DISEASE: where antibodies are formed against the adrenals or
• A severe infection like MENINGOCOCCEMIA that shuts the adrenals down or
• CORTICOSTEROID WITHDRAWAL SINDROME: This is the case of a patient who after having been on synthetic glucocorticoids for a long time abruptly stops taking them. I'll explain. Patients who have been taking synthetic glucocorticoids for a long time suppress the adrenal gland. This means that the gland stops making corticosteroids because the patient is already getting them in the pills. The gland gets “lazy”. To avoid this from happening, patients on glucocorticoids should be tapered off slowly to give the adrenal gland time to get used to making them again.

SOME SIGNS OF ADDISON'S DISEASE are:

• WEAKNESS
• DARKENED SKIN: due to elevated ACTH in this disease which pigments the skin.
• LOW BLOOD PRESSURE and
• WEIGHT LOSS
**DIAGNOSIS**: the specific blood test for Addison's is the: **ACTH TEST**

**TREATMENT**: **GLUCOCORTICOID REPLACEMENT** which means that glucocorticoids are given by mouth to fill in for the ones the gland isn't making

3) **PHEOCHROMOCYTOMA**: is a tumor of the adrenal medulla that secretes catecholamines which cause the symptoms.

**SYMPTOMS**: are classically **EPISODES** of:
- **HIGH BLOOD PRESSURE**
- **PALPITATIONS**
- **SWEATING and**
- **TREMORS**

**DIAGNOSIS**: blood tests that measure the levels of
- **CATECHOLAMINES and METANEPHRINE** (a metabolite of adrenaline)
- **CT or MRI OF THE ADRENALS** is done to locate the tumor.

**TREATMENT**: **SURGICAL REMOVAL OF THE TUMOR**

The doctors who specialize in the field of **ENDOCRINOLOGY** are called: **ENDOCRINOLOGISTS**

**TERMINOLOGY REVIEW.** Now it's time for review so let's go over the terminology mentioned in this presentation in English and in the target language.

1) **THYROID**: tiroides
2) **PARATHYROID**: paratiroides
3) **SUPRARENAL/ADRENAL**: suprarrenal
4) **REGULATE**: regular
5) **METABOLISM**: metabolismo
6) **GROWTH**: crecimiento
7) **DEVELOPMENT**: desarrollo, formación
8) **LEVOThYROXINE**: levotiroxina
9) **CALCITONIN**: calcitonina
10) **CORTICOSTEROIDS**: corticoides
11) **HYDROCORTISONE**: hidrocortisona
12) **ADRENALINE**: adrenalina
13) **PHEOCHROMOCYTOMA**: feocromocitoma
14) **HYPERPARATHYROIDISM**: hiperparatiroidismo
15) **ASYMPTOMATIC**: asintomático
16) **HYPOPARATHYROIDISM**: hipoparatiroidismo
17) **HYPOTHYROIDISM**: hipotiroidismo
18) **HASHIMOTO'S DISEASE**: enfermedad de Hashimoto
19) **ENDEMIC GOITER**: bocio endémico
20) **INTOLERANCE TO COLD**: intolerancia al frio
21) **CONSTIPATION**: estreñimiento
22) **WEIGHT GAIN**: aumento de peso
23) **DRY SKIN**: piel seca
In this presentation we have gone over many terms related to ENDOCRINOLOGY while we discussed the signs and symptoms of sickness and diseases. We also discussed some of the diagnostic procedures and treatments used. At the end of the presentation a list of 59 related terms were provided in English and the target language for you to review. I hope you’ve enjoyed this lesson and come away with a better understanding of ENDOCRINOLOGY and the terms related to this field of medicine.

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