بسم الله الرحمن الرحيم

Adrenal Gland Disorders

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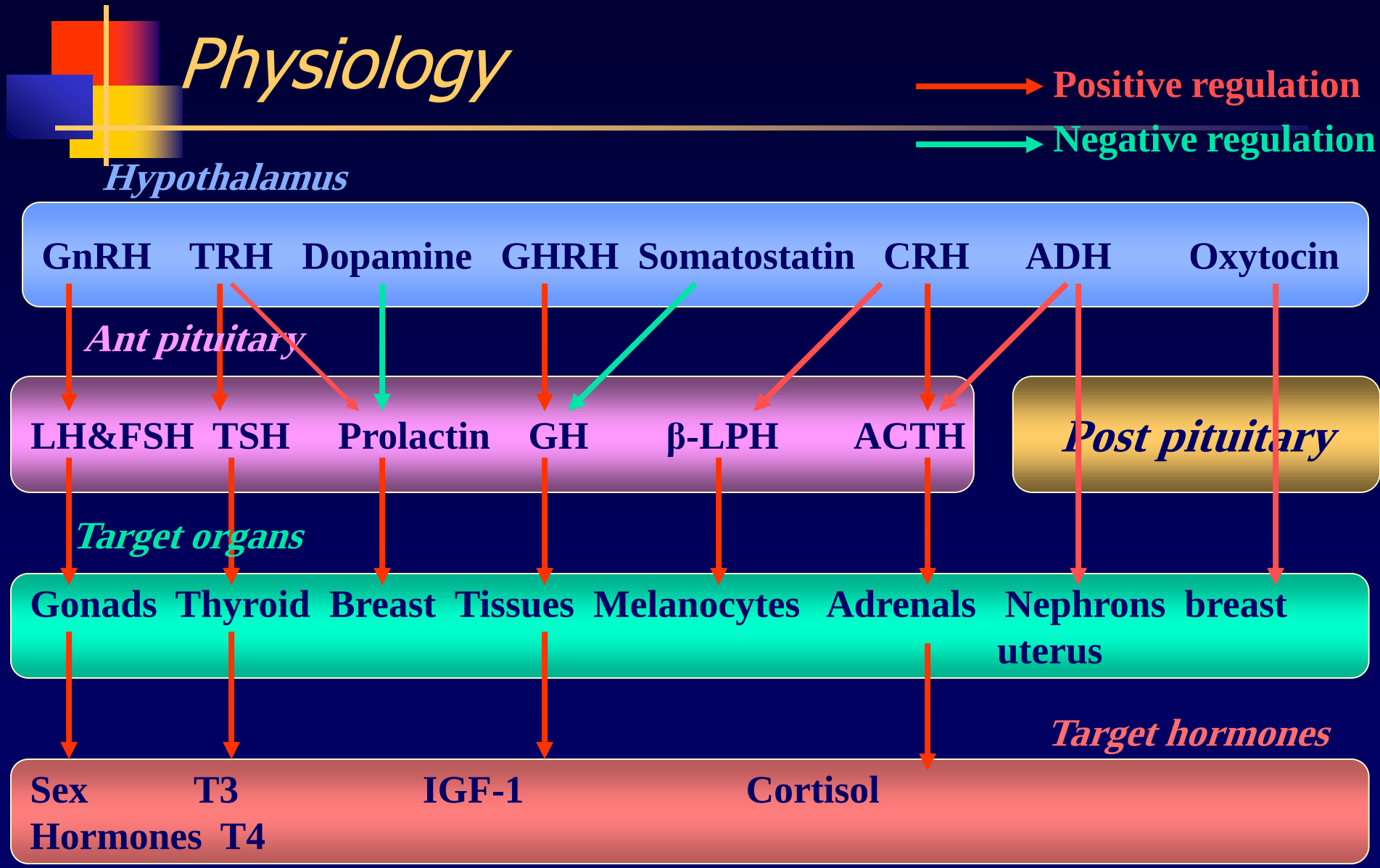

Positive regulation
Negative regulation
Hypothalamus
GnRH TRH Dopamine GHRH Somatostatin CRH ADH Oxytocin
Ant pituitary
LH&FSH TSH Prolactin GH β-LPH ACTH
Post pituitary
Target organs
Gonads Thyroid Breast Tissues Melanocytes Adrenals Nephrons breast uterus
Target hormones
Sex Hormones T3 T4 IGF-1 Cortisol

Functional Anatomy and Physiology

- *Adrenal cortex*

1. Zona glomerulosa → Aldosterone
2. Zona fasciculata } → Cortisol
3. Zona reticularis } → Adrenal androgens

- *Adrenal Medulla*

Component of the sympathetic nervous system
The medulla synthesizes, stores and secretes catecholamines.

Functional Anatomy and Physiology

- *Glucocorticoids*
- Major one in human is cortisol.
- Diurnal pattern of secretion via ACTH stimulation.
- Rise dramatically during stress.
- 95% bound to cortisol-binding globulin.
- Has a minimal mineralocorticoid activity.
- *Principal functions:*

1. Regulation of carbohydrate metabolism.
2. Increase protein catabolism.
3. Immunomodulation.
4. CV regulation.

Functional Anatomy and Physiology

- *Mineralocorticoids*
- Major one is Aldosterone.
- It is the most important sodium-retaining hormone.
- The principal stimulus is Angiotensin-II (renin-angiotensin system).
- *Principal functions:*

1. Sodium retention.
2. Potassium excretion.

Functional Anatomy and Physiology

- *Catecholamines*
- Small proportion of circulating noradrenaline is secreted from adrenal medulla, much more is released from the nerve endings.
- Conversion of noradrenaline to adrenaline is induced by glucocorticoids.
- *Principal functions:*

1. Increase heart rate.
2. Regulation of vascular tone.
3. Antagonise insulin action.

Hyperaldosteronism

Hyperaldosteronism

- *Primary hyperaldosteronism*

Causes

1. Adrenal adenoma (Conn's syndrome); 60%
   often very small, occur in young females.
2. Bilateral adrenal hyperplasia;
   more common in males, rare before 40ys.

Secondary Hyperaldosteronism

- Causes

1. Accelerated hypertension
2. Renal artery stenosis.
3. Heart failure.
4. Liver cirrhosis

Primary Hyperaldosteronism

- *Clinical features*

1. Hypertension ; almost invariable but it is a rare cause of secondary hypertension (<1%).
2. Hypernatremia and increased potassium excretion. Hypokalemia ⟶ muscle weakness, polyuria, secondary to tubular damage (nephrogenic diabetes insipidus).
3. Peripheral edema may occur.

Endocrine causes of hypertension

- Phaeochromocytoma
- Adrenal adenoma (Conn syndrome)
- Acromegaly
- Cushing syndrome
- Thyrotoxicosis
- Myxedema
- Liquorice ingestion (inhibits 11β-hydroxylase)

Investigations

- Beta-blockers and other drugs may interfere with renin activity, and spironolactone, angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor antagonists will all affect results; all should be discontinued, if possible.

1. Hypokalemia, increased urinary potassium excretion.
2. Increaased k daily excretion in urine
3. Increased plasm aldosterone/ renin ratio.
4. High plasma aldosterone not suppressed by 0.9% saline infusion or fluodrocortisone injection.
5. Investigation for the cause; adrenal CT or MRI, venous catheterization of the adrenal glands for aldosterone level.

Treatment

1. Adenoma; surgical removal.
2. Aldosterone antagonist; spironolactone 100-400 mg/day. Side effects; skin rash, nausea, gynecomastia.
3. Aldosterone receptor antagonist eplerenone can be use if there is side effects of spironolactone.

Pheochromocytoma

Pheochromocytoma

- Catecholamine excess: pheochromocytoma
- Rare tumor of chromaffin tissue which secretes catecholamines.
- Responsible for <0.1% of cases of hypertension.
- 10% are malignant.
- 10% are extra-adrenal.
- 10% are familial.

Pheochromocytoma

- **Some are associated with:**
- MEN 2 syndrome.
- Tuberous sclerosis
- Von Hipple Lindeau disease

Clinical features

1. Hypertension (usually paroxysmal, sometimes orthostatic hypotension).
2. Cyanosis and Raynaud syndrome due to vasosspasm.
3. CVS: palpitation, tachycardia, arrhythmias, chest pain, acute coronary syndrome, cardiomyopathy, and heart failure.
4. Abdominal pain, nausea or vomiting, constipation or diarrhea and intestinal ischemia.
5. Glucose intolerance Or DM .
6. Occasionally; complications of hypertension as stroke, myocardial infarction, retinopathy
7. Weight loss

Clinical features

- Headache, sweating, pallor or flushing.
- Attacks of anxiety or even panic attacks
- CNS: Headache, paresthesias, numbness, dizziness, TIA, hemiplegia, seizures, hemorrhagic stroke.
- Multisystem crisis: Severe hypertension/ hypotension, fever, encephalopathy, renal failure, ARDS, death

Causes of death in patients with unsuspected pheochromocytomas

- Myocardial infarction
- Cerebrovascular accident
- Arrhythmias
- Irreversible shock
- Renal failure
- Dissecting aortic aneurysm
- Acute respiratory distress syndrome

Investigations

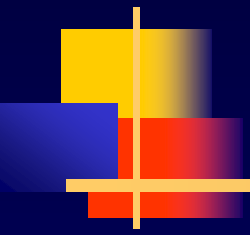
1. Direct measurement of plasma catecholamines.
2. Measurement of urinary metabolite (metanephrines), 24 h urinary collection is more useful as the secretion is usually paroxysmal.
3. Clonidine suppression test.
4. Plasma chromogranin A (a storage vesicle protein) is raised.
5. Localization of the tumor; abdominal CT or MRI.
6. Extra-abdominal sites can be detected by scintigraphy using meta-iodobenzyl guanidine (MIBG) labelled with radioactive iodine.
7. Positron emission tomography (PET) is also used by some centers in the localization of pheochromocytomas
8. Genetic testing should be performed in all people with confirmed pheochromocytoma or paraganglioma.

Treatment

1. Surgical removal (5-year survival is about 95% for non-malignant Tumours).
2. Medical therapy for preparation of the patient for a minimum 6 weeks; complete alpha and beta blockade by phenoxybenzamine (20-80 mg daily) then propranolol (120-240 mg daily)
3. sodium nitroprusside and phentolamine (a rapid-acting α-blocker) should be available in case sudden severe hypertension develops.

Multiple endoccrine neoplasia (MEN)

- MEN 1
  - Parathyroid
  - Pituitary
  - Pancreas
  - Adrenal
  - Thyroid
- MEN 2
  - Adrenal
  - Thyroid
  - Parathyroid



Thank you