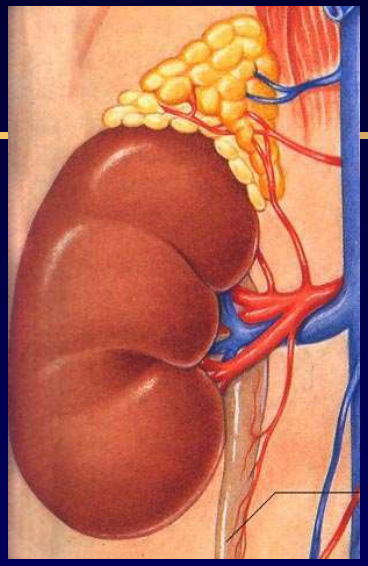
Adrenal Gland Disorders

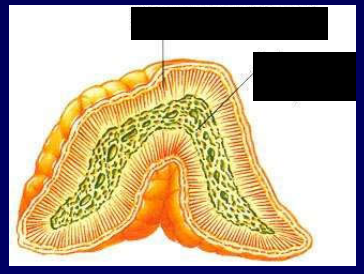
BY

DR. Ahmed Elsharawy .MD.PHD

Lecturer of Internal Medicine,

CARDIOLOGY BRANCH





The *adrenal glands* are the pair endocrine gland, located above the superior kidneys' poles. They are against the interspace between the first lumbar vertebra and eleventh thoracic vertebra. They have triangular form.

The weight of both adrenal glands is 6 to 12 g, the length is 4-6 cm, the width is 2-3 cm, and the thickness is to 1 cm.

The external portion of the adrenal gland is surrounded by the connective tissue capsule.

The adrenal gland consists of outer *cortex* and an inner *adrenal medulla*.

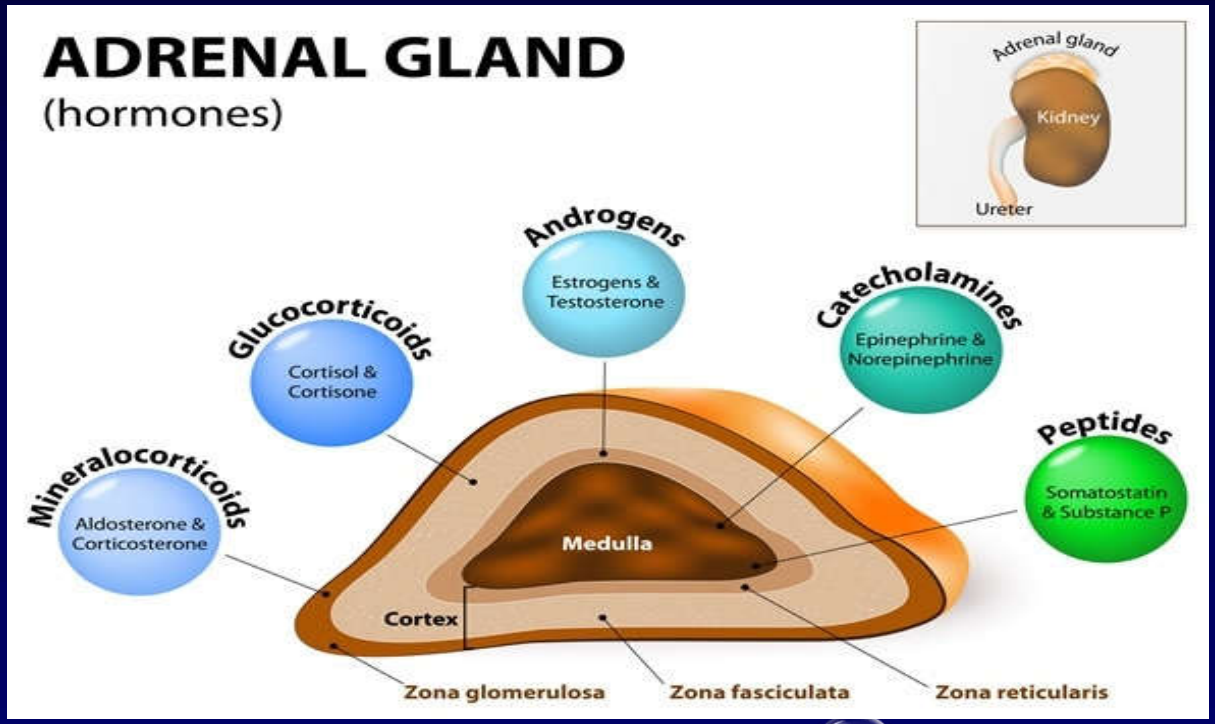
Functional Anatomy and Physiology

- *Adrenal cortex*

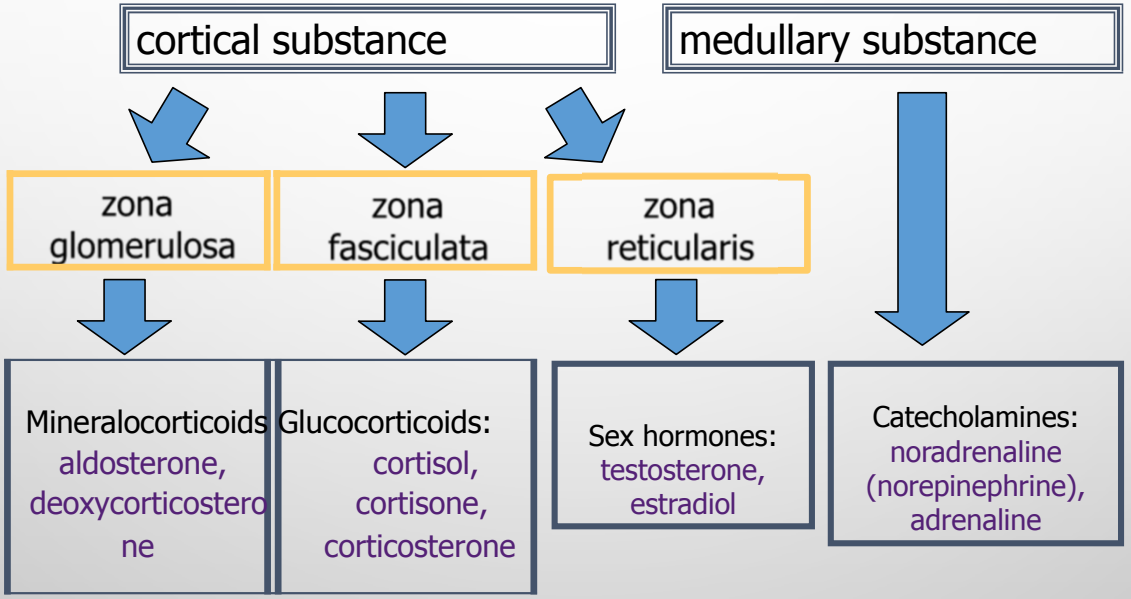
1. Zona glomerulosa → Aldosterone
2. Zona fasciculata } → { Cortisol
3. Zona reticularis } → { Adrenal androgens

- *Adrenal Medulla*

Component of the sympathetic nervous system → Catecholamines.


ADRENAL GLAND
(hormones)
Adrenal gland
Kidney
Ureter
Androgens
Estrogens & Testosterone
Glucocorticoids
Cortisol & Cortisone
Catecholamines
Epinephrine & Norepinephrine
Peptides
Somatostatin & Substance P
Mineralocorticoids
Aldosterone & Corticosterone
Medulla
Cortex
Zona glomerulosa
Zona fasciculata
Zona reticularis

ADRENAL GLANDS



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 principle stimulus is Angiotensin-II (renin-angiotensin system).
- *Principal functions:*

1. Sodium retention.
2. Patassium excretion.

Functional Anatomy and Physiology

- *Catecholamines*

- Man, 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.

Classification

Adrenocortical hyperfunction

There are 3 basic types of corticosteroids elaborated by the adrenal cortex *"glucocorticoids, mineralocorticoids,* and *sex hormone"* and 3 distinctive hyperadrenal clinical sydromes:

- Cushing syndrome "excess cortisol"
- Hyperaldosteronism
- Adrenogenital syndromes "excess androgen"

Adrenal Hypofunction

- Adrenal insufficiency leads to a reduction in the output of adrenal hormones
  - glucocorticoids and/or mineralocorticoids
- Two types of adrenal insufficiency
  - **Primary insufficiency**
    - inability of the adrenal glands to produce enough steroid hormones
  - **Secondary insufficiency**
    - inadequate pituitary or hypothalamic stimulation of the adrenal glands

Glucocorticoid excess; Cushing's syndrome

- *Etiological classification*

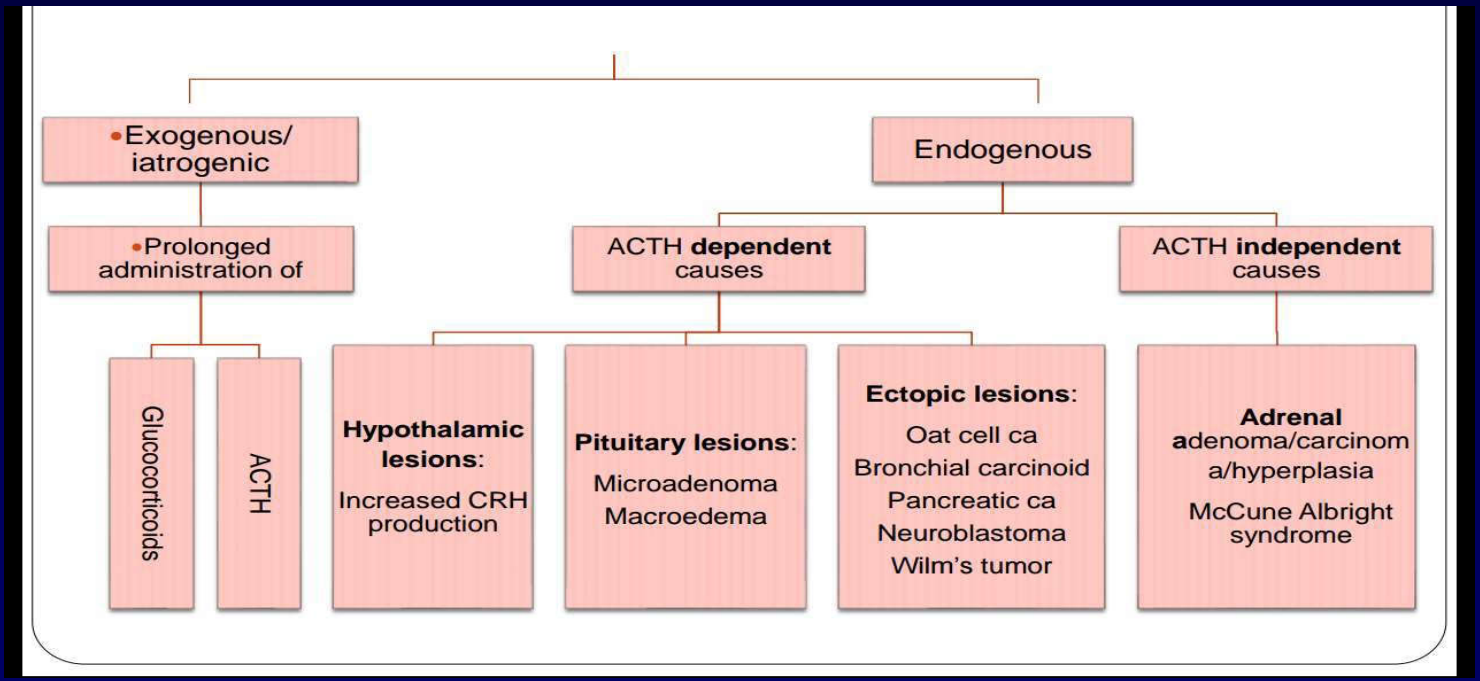
1. ACTH dependent:

- Pituitary- dependent (Cushing's disease).
- Ectopic ACTH secretion.

2. Non-ACTH-dependent:

- Adrenal hyperplasia, adenoma or carcinoma.
-

Etiology


•Exogenous/ iatrogenic
Endogenous
•Prolonged administration of
ACTH dependent causes
ACTH independent causes
Glucocorticoids
ACTH
Hypothalamic lesions:
Increased CRH production
Pituitary lesions:
Microadenoma
Macroedema
Ectopic lesions:
Oat cell ca
Bronchial carcinoid
Pancreatic ca
Neuroblastoma
Wilm's tumor
Adrenal adenoma/carcinoma/hyperplasia
McCune Albright syndrome

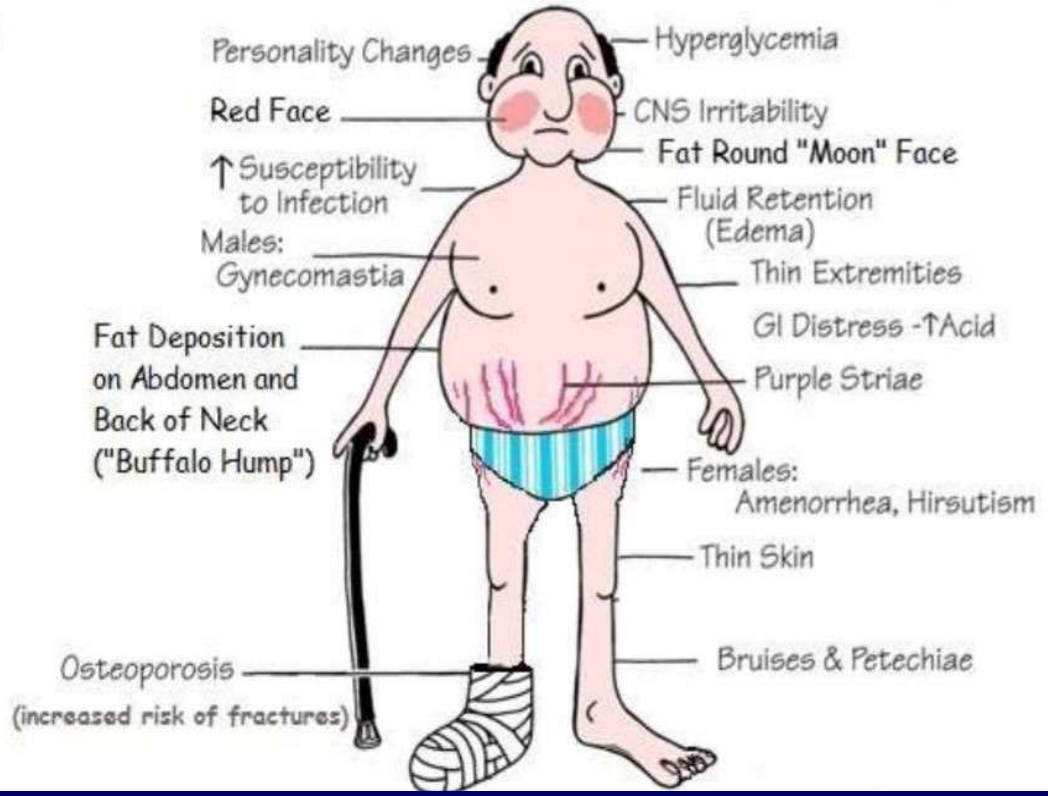
Cushing's syndrome; Clinical features

1. Weight gain (central obesity), moon face, dorsal fat pad.
2. Plethora, acne, Hirsutism, scalp hair-thinning, frontal balding.
3. Depression/ psychosis, insomnia.
4. Skin; thin skin, infections, easy bruising, striae, pigmentations, poor wound healing.
5. Musculoskeletal; back pain, osteoporosis, kyphosis, muscular weakness, proximal muscle wasting, pathological fractures.
6. Menstrual irregularities, decreased libido.
7. Hyperglycemia, hypertension.

Cushing's syndrome; Clinical features

1. Pigmentation occurs only with ACTH – dependent causes.
2. Pseudo-cushing; cushignoid appearance can occur with excess alcohol consumption.
3. Impaired glucose tolerance and hypokalemia are more common with ectopic ACTH secretion.

Cushing's Disease or Syndrome Symptoms



Cushing's syndrome; Investigations

- *Investigations to confirm the diagnosis:*

1. 24-h urinary cortisol level.
2. Diurnal rhythm of plasma cortisol.
3. Low dose Dexamethasone suppression tests; (0.5 mg/6h for 48 h). Normal response: plasma cortisol less than 50nmol/L by the end of the test.

Cushing's syndrome; Investigations

- *Investigations for the cause:*

1. Adrenal CT or MRI
2. Chest x-ray
3. High-dose dexamethasone-suppression test; 2mg/6h for 2 days; in pituitary dependent disease; plasma cortisol on day 2 is less than 50% that on day 0, failure of suppression suggests ectopic source or adrenal tumor.
4. Plasma ACTH level

Cushing's syndrome; Treatment

- *Medical treatment*

1. **Steroidogenic inhibition**: Metayrapone; 11-B hydroxylase blocker. Given in doses of 750-4 g daily in 3-4 divided doses.
2. Ketoconazole (200mg 3times/day); synergestic to metyrapone to reduce its dose.

- *Treatment of the cause*

Surgical tx

Cushing's disease

- Trans sphenoidal microadenomectomy
- Pituitary radiation
- Bilateral total adrenolectomy

Ectopic ACTH Syndrome

- Surgical removal of the ectopic tumor
- Radiotherapy

Glucocorticoid receptor antagonist

RU486

Thanks