

Adrenal Cortical Hormones

Part 1

(Mineralocorticoids)

Objectives:

1. To study the adrenal cortex hormone biosynthesis.
2. To verify the control, effects of mineralocorticoids and the disorders of their secretion.

The adrenal gland consists of 2 parts:

1. The outer part: the adrenal cortex which is part of the endocrine system,
2. The inner part: the adrenal medulla which is part of the autonomic nervous system.

The adrenal cortex has 3 distinct layers (Zones):-

The outer layer called **Zona Glomerulosa** “ ZG”

The middle layer called **Zona Fasciculata** “ ZF”

The inner layer called **Zona Reticularis** “ ZR”

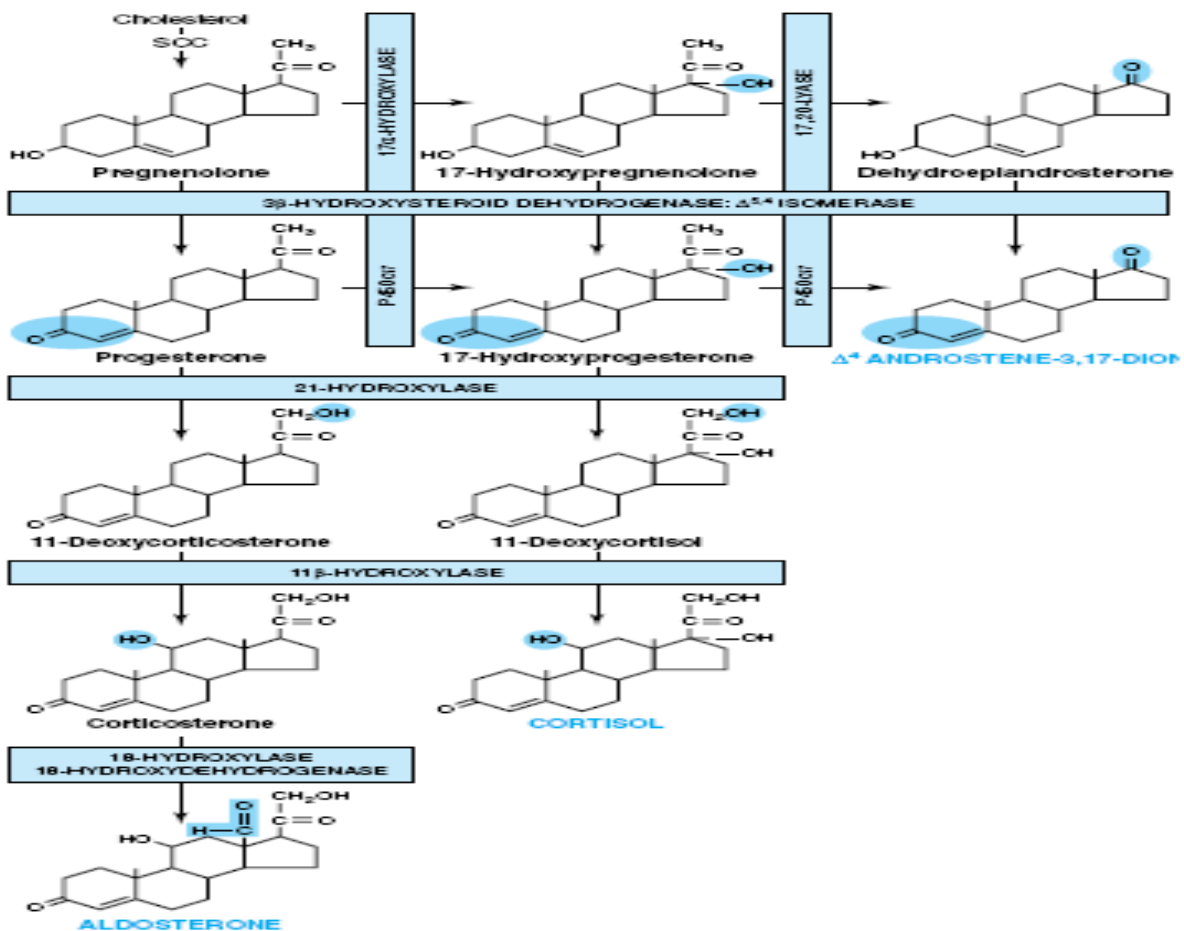
ZG produces Mineralocorticoids

ZF and ZR produces Glucocorticoids and Androgens.

Biosynthesis of adrenal steroids:-

They are synthesized from *Cholesterol* via *Pregnenolone* which is the precursor of the 3 major adrenal steroids:

1. Mineralocorticoids .
2. Glucocorticoids.
3. Androgens.



Granner DK. Diversity of the endocrine system. In: Murray RK, Granner DK, Mayes PA, Rodwell VW, eds. Harpers's Illustrated Biochemistry. 26th edn, New York: Lange Medical Books/McGraw-Hill; 2003: 434-455.

Mineralocorticoids

They are C21 steroids .

Aldosterone is the most potent in this class and is made exclusively by ZG.

Control of Aldosterone secretion

1. Renin-Angiotensin system:

A: the juxta-glomerular apparatus in the renal afferent arterioles secretes renin in response to: hypotension, NaCl depletion, change from supine to erect posture and other factors.

B: Renin converts Angiotensinogen (produced by the liver) into Angiotensin I.

C: Angiotensin converting enzyme (plasma , Lungs) converts Angiotensin I into Angiotensin II

D: Angiotensin II stimulates Z. G. to produce Aldosterone.

E: aldosterone binds to mineralocorticoid receptors in the DCTs of the kidneys resulting in :

1. ↑ BP
2. Na⁺ retention
3. K⁺ loss

2. Plasma K⁺ level :-

Aldosterone secretion is extremely sensitive to changes in plasma K⁺ level .

An increase as small as 0.1 meq/L of plasma K⁺ is a stimulant for aldosterone production.

3. ACTH and Plasma Na⁺ level:-

In certain circumstances, they may be involved in aldosterone secretion.

Pathophysiology

Mineralocorticoids Deficiency (Aldosterone underproduction)

Occurs in association with glucocorticoids deficiency in:

Primary (Addison's disease)

Due to primary adrenocortical failure and characterized by:

- Postural hypotension
- Hyponatraemia
- Hyperkalaemia.

Mineralocorticoids Excess (Aldosterone overproduction)

Causes:-

1. High Renin / High aldosterone (Secondary hyperaldosteronism)
 - A. Inadequate renal perfusion (diuretic therapy, cardiac failure, liver failure, nephrotic syndrome, renal artery stenosis
 - B. Renin- secreting renal tumours (very rare)
2. Low Renin / High aldosterone (Primary hyperaldosteronism) (Conn's syndrome)
3. Low Renin / Low aldosterone (non- aldosterone- dependent activation of mineralocorticoid pathway)

Clinical presentation of patients with Conn's syndrome:

- 1. Features of Na⁺ retention and K⁺ loss**
- 2. Hypertension**

Investigations:

- 1. Electrolytes: Hypernatraemia, hypokalaemia**
- 2. Aldosterone: Renin ratio.**
- 3. Saline infusion test.**
- 4. Fludrocortisone suppression test.**