

Zona granulosa and Fasciculata

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Adrenal gland

- Top of the kidney (suprarenal gland)
- Pyramid gland
- cortex

granulosa mineralocorticoids

fasciculata (biggest Layer) glucocorticoids

Reticularis androgens

Adrenal medulla (neural tissue) catecholamines

Mechanism of secretion of Zona granulosa

- Low blood pressure

In the kidney ,Renin(Juxtaglomerular cells)

Liver plasma protein enzyme (angiotensinogen)

Renin(enzyme) convert angiotensinogen,
angiotensin one

Lung angiotensin converted enzyme(A.C.E) ,
angiotensin one into two

- Angiotensin two , G receptor coupled protein, G stimulatory protein, convert GDP into GTP, adenylate cyclase, ATP into cAMP, Protein kinase P.K.A (the strongest stimulus)
- Paraventricular nucleus corticotropin releasing hormone, anterior pituitary adrenocorticotropin hormone (weakest stimuli in stress conditions) , the same pathway of angiotensin two

Steroid hormone synthesis

Cholesterol , pregnenolone, progesterone by 21-hydroxylase , 11-deoxy corticosterone, corticosterone, Aldosterone (the second stimulus)

P.K.A phosphorylating each enzyme in each step
Low sodium (hyponatremia) or high potassium (hyperkalemia) level in the blood

Inhibitors

- Blood pressure high

Atrial natriuretic peptide (strongest), G
inhibitory pathway, K efflux (hyperpolarization) ,
alter the enzymatic activity

Effect of aldosterone

Bind to Trans cortin (corticosteroid binding globulin) or albumin, distal convoluted tubules,

Inside the cell activate gene sequence ,
transcription mRNA translation proteins

Very slow action

Overall effect

Plug three different types of protein into the cell membrane

Sodium potassium pump establish gradient

More pumps for sodium in the luminal membrane from the filtrates into the blood

Potassium from the blood excreted through distal convoluted tubules

Increase blood volume

Increase blood pressure

Mechanism of secretion of cortisol

- Paraventricular nucleus, corticotropin releasing hormone , hypophyseal system, anterior pituitary gland ,adrenocorticotrophic hormone (strongest stimulator)
- G protein coupled receptors, G stimulatory protein, GTP, Adenylate cyclase, ATP to c. AMP, protein kinase A P.K.A (phosphorylating different kinds of protein)

Steroid hormones

- Cholesterol is the basic unit to make steroid hormones not DNA or mRNA or proteins
- Cholesterol, pregnenolone, progesterone, 17-hydroxy progesterone by 21- Hydroxylase
11- deoxy cortisol, cortisol

P.K.A phosphorylating different enzymes involved within enzymatic reaction

Effect of cortisol

- 25% of cortisol bind to albumin
- 75% bind to corticosteroid binding globulin (trans Cortin)

Muscle and bone (Protein catabolism) 5-6mm
40 mg prednisone /day /year. 1/5 of contact
bone

Binds intracellular receptors

Proteases break the peptide bond

Releasing Amino acids into blood

Amino acids to liver

Adipocyte

Triglycerides(glycerol to liver, Fatty acid chains utilized by muscles or redistributed in different part of the body)

Liver (hyperglycemia); **increase insulin from pancreas**

Gluconeogenesis Glycerol, amino acids, lactic acids, fatty acids and converted to glucose

Glycogenesis (converting glucose into glycogen)

Direct effect

Glycogenolysis (breaking glycogen into glucose)
by stimulating adrenergic receptors in the liver

indirect effect

Tunica media of Smooth muscle (vasocontraction and increase blood pressure)

Sensitivity of adrenergic receptors amplify the effect of norepinephrine

Inhibit Immune system

Basophiles (histamine (very potent in allergic), leukotriene, prostaglandins)

Lymphocytes (interleukins, cytokines)

Monocytes (interleukins, Cytokines)

Secretion of cortisol

Hypoglycemia

Glycogenolysis (indirectly)

Gluconeogenesis

Glycogenesis (direct)

Long term stress (chronic stress) >1 or 2min

Trauma or starvation or emotional

Vasocontraction (increase blood pressure)

Protein catabolism

Depression of immune system

High cortisol

Negative feedback effect on hypothalamus
(CRH)

Negative feedback effect on anterior pituitary
gland (ACTH)

Low cortisol

High CRH and ACTH

- Cushing Excess cortisol

normal

1. 1mg Dexamethasone suppression 2mg blood

Urine free 24hrs <2mg

2. 2mg dex positive >2mg

3.

ACTH low adrenal tumor (benign or malignant)

ACTH high pituitary or Ectopic

4. 8mg DEXA

Pituitary suppression Cushing disease

Ectopic not suppress tumors

Hyperaldosteronism

- Primary: Conn's syndrome (adenoma), genetic, idiopathic . Low renin high aldosterone
- Secondary: chronic low of blood pressure (congestion of heart disease), cirrhosis. High aldosterone and Renin

Insufficiency of adrenal gland

- Addison's disease low cortisol

Autoimmune or tumor

Hyperkalemia

Dark pigmentation alpha melanocyte

Opposite of cortisol excess