Physiology Team

ENDOCRINE BLOCK

LECTURE 12

Adrenal Androgens & Adrenal Insufficiency

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OBJECTIVES

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Not Given :|

MIND MAP

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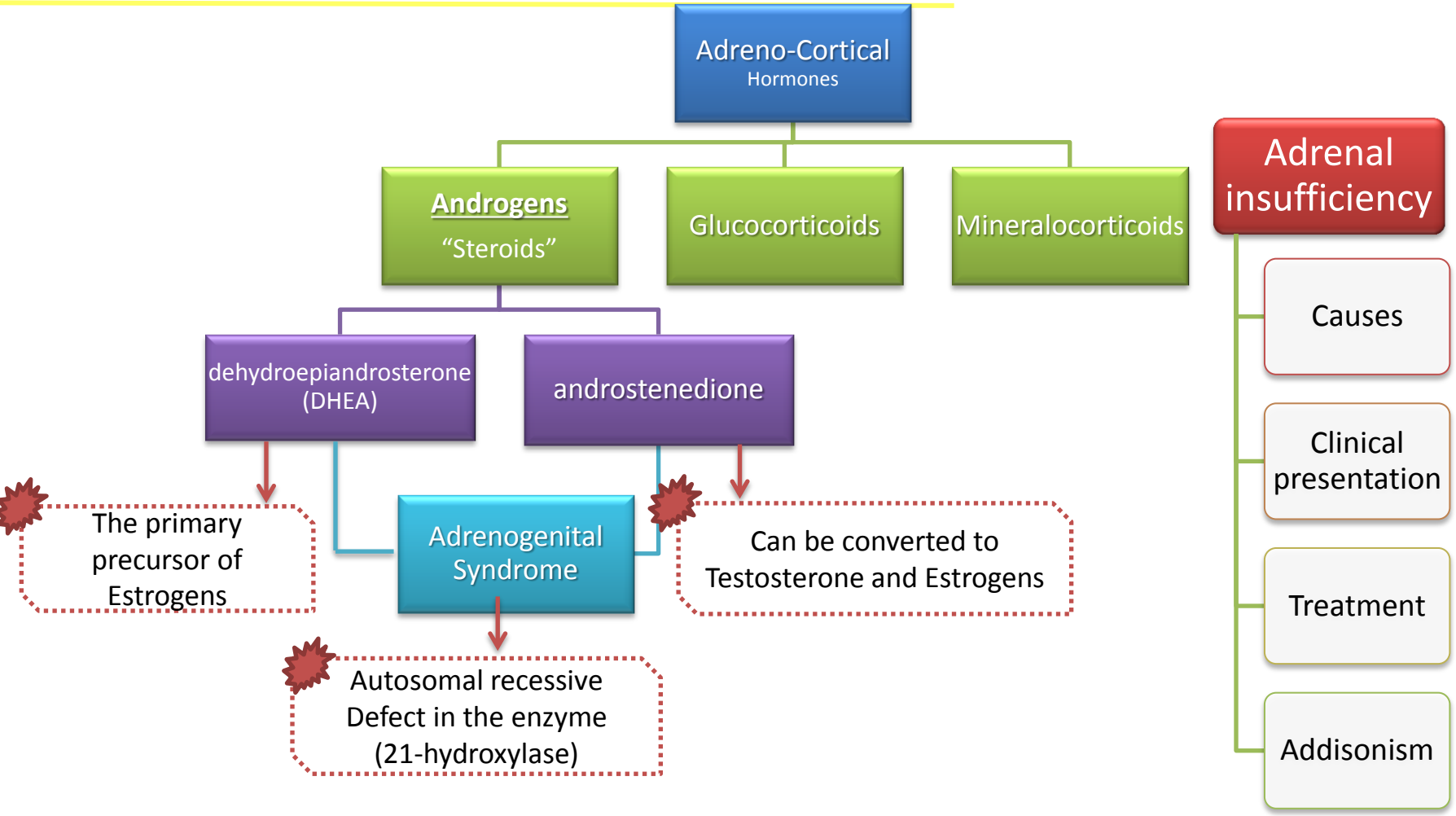

Androgens

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*Androgens are the hormones that exert **masculinizing effects** >> seen normally in male. But for female, it causes hairstusm and deepening of the voice.

*Promote anabolism and growth >> it is thought these androgens could treat osteoporosis especially in female. Also for cachexia patient for protein synthesis.

*Testosterone from the testis is the major active androgen.

*The adrenal androgens have less than 20% of its activity.

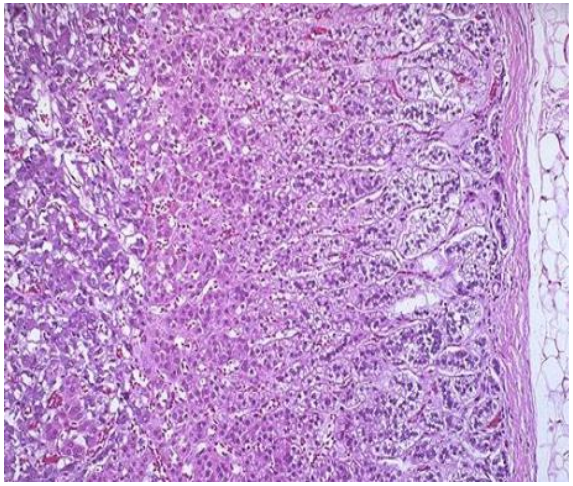
*They are **present both in males & females**.

*Androgens are converted to Estrogen in both male and female. But if the estrogen level increase in male "pathologic condition as liver failure ,liver is the site of its elimination," the result is feminizing effect.

***Zona reticularis :** Produces small amounts of androgens, **mostly dehydroepiandosterone (DHEA),** DHEA may be converted into estrogens, androstenedione.

***Hormone Control:** Believed to be ACTH

***Target tissue:** General body cells



Adrenal Androgens

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- The adrenal cortex produces both androgens i.e."male sex hormones" and estrogens or "female sex hormones.
- The adrenal cortex in both sexes produces **small amounts of sex hormone of the opposite sex** >> Excess increase in opposite sex will lead to behavior associated disorders.
- Additional small amounts of sex hormones come from nonadrenal sources.
- Some testosterone in males is converted into estrogen by the enzyme **aromatase found in adipose tissues** >> Increase fat will increase the estrogen.
- In females, **ovaries** produce androgen as an intermediate step in estrogen production. Little of this androgen is released in the blood instead of being converted into estrogen.

Androstenedione Vs. DHEA

Important

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	Androstenedione	DHEA
Nature	BOTH ARE STEROIDS	
Source	testes, adrenal cortex, and ovaries	Adrenal cortex (from cholesterol)
Feature	- Androstenediones are **converted metabolically to testosterone and to estrogens** in the fat and other peripheral tissues. - It is an important source of estrogen in men and postmenopausal women. - Androstenedione were used as an athletic or body building supplement.	- Primary precursor of natural estrogens. - It is the most abundant adrenal androgen
Effect female	1- growth of pubic and axillary hair, 2- pubertal growth spurt, 3- development and maintenance of female sexual drive.	these effects appear in female at adolescence

Adrenogenital Syndrome "Congenital adrenal hyperplasia"

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Important

Causes:

*Inherited as autosomal recessive diseases and can affect both boys and girls.
*The defect is lack of an enzyme (21-hydroxylase) needed by the adrenal gland to make the major steroid hormones of the adrenal cortex: cortisol and aldosterone. *Due to the block in synthesis of these hormones, there is abnormal 'feedback' and steroids are 'diverted' to becoming androgens, a form of male sex hormones.

	MALE	FEMALE
Feature	- In pre-pubertal males it causes the rapid develop of secondary sexual characters - Lower half of body shows clear changes	- beard growth, deeper voice, masculine distribution of body hair, and growth of the clitoris to resemble a penis. ***Picture:** -Virilizing adrenal hyperplasia in a newborn female baby - DHEA was converted to Testosterone

Adrenal Insufficiency

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- is a condition in which the adrenal glands do not produce adequate amounts of steroid hormones, primarily cortisol; but may also include impaired production of aldosterone(a mineralocorticoid)
- Adrenal insufficiency is more dangerous than cushing disease , the latter can be excised if it's tumor or stop the exogenous cortisol

Causes:

Primary	Secondary	Tertiary
Failure of adrenal glands **(Addison's Dis)** .All three hormones of adrenal cortex will be deficient. *it could be autoimmune diseases.	Failure of Hypothalamic-pituitary- axis: Usually due to chronic exogenous glucocorticoid administration pituitary failure.	Hypothalamic dysfunction.

Primary Adrenal Insufficiency

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- Loss of all three types of adrenal steroids.
- 90% of glands must be destroyed to manifest clinically.
- Progressive neurological symptoms from demyelination

Addison diseases:

There is decreased synthesis of all adrenocortical hormones, resulting in decreased circulating levels of cortisol, aldosterone, and adrenal androgens.

CAUSES
1-Autoimmune 2-Thrombosis/hemorrhage 3-Infiltrative diseases 4-Bilateral cancer metastasis 5-Radiation 6-chronic infection, mainly fungal infections. 7-cancer cells spreading from other parts of the body to the adrenal glands. 8-amyloidosis 9-surgical removal of the adrenal glands.

metabolic failure, ketoconazole, Secondary causes: hypopituitarism, suppression by exogenous steroid

Addison Symptoms

EXTRA SLIDE

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Loss of cortisol	Loss of aldosterone	Loss of androgens
Hypoglycemia Anorexia Weight loss Nausea Vomiting Weakness	Hyperkalemia Metabolic acidosis Hypotension	In women, decrease pubic and axillary hair and decreased libido.

Hyperpigmentation:

is a result of increased levels of ACTH (Which contain the alpha-MSH fragment)

ACTH levels must be high, not low, and the cause of the hypocortisolism must not be a primary defect in ACTH secretion from the anterior pituitary. Rather, the hypocortisolism of Addison's disease must be due to a primary defect in the adrenal cortex itself (Primary Adrenal Insufficiency), with low levels of cortisol then causing an increase in ACTH secretion by negative feedback).. **Linda's book page418, Fourth edition**

Adrenal Crisis (Addisonian Crisis)

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CLINICAL PRESENTATION:

It's a chronic progressive disease leads to chronic loss of function
*Life-threatening emergency
*HYPOTENSION
*Typically resistant to catecholamine and IVF
Resuscitation (giving cortisol is better than catecholamine)

Addison's Crisis (Adrenal crisis)

Cause:

Abrupt adrenal failure usually from gland hemorrhage or infection or thrombosis

Clinical manifestations of Addisonian Crisis:

*Sudden penetrating pain in lower back or abdomen.(acute abdomen >> thrombosis from abdominal pain)
*Severe vomiting and diarrhea, resulting in dehydration
*Low BP
*Loss of consciousness
*Hypoglycemia
*Severe lethargy
*Hyponatremia
*Hyperkalemia
*Convulsions
*Fever

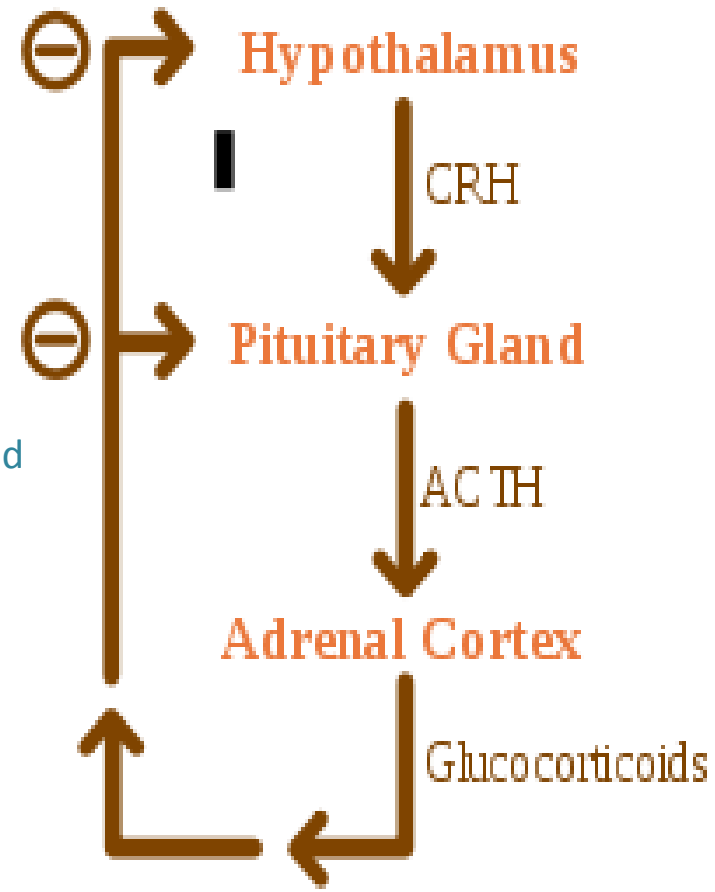
Important

Treatment

*Glucocorticoids
*Correct volume and sugar deficits (IV fluid for hypoglycemia)

CLINICAL PRESENTATION:

*Are due to deficiency of glucocorticoids and aldosterone
*Nonspecific
*Fatigue, anorexia, weight loss, loss of libido
*Neurological
*Headaches, visual changes, diabetes insipidus
*Gastrointestinal.
*Pain, nausea, vomiting, diarrhea
*Skin pigmentaions (Hyperpigmentation)
*Muscle & joint pain
*Hypotension (postural due to Na absence),volume depletion and shock/Orthostasis
*Patient cannot cope with stress
*Cachexia
*Thin axillary and pubic hair in women
*Hypoglycemia
*Normocytic anemia (because cortisol increases RBC count)
*Hyponatremia
*Hyperkalemia
*Mild acidosis



SUMMARY

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- Androgens are the hormones that exert masculinizing effects and promote anabolism and growth Of adrenocortical hormones.
- Testosterone in males is converted into estrogen by the enzyme
- aromatase found in adipose tissues .
- Androstenediones are converted metabolically to testosterone
- and to estrogens in the fat and other peripheral tissues.
- The lack of an enzyme (21-hydroxylase) will cause Adrenogenital Syndrome
- Disorders involving the adrenal cortex are characterized by either an excess or a deficiency of adrenocortical hormones.
- Cortisol promotes gluconeogenesis, and therefore, excess levels will produce hyperglycemia, defects will produce hypoglycemia upon fasting.
- Addison's disease is a primary adrenocortical insufficiency, is commonly caused by autoimmune destruction of all zones of the adrenal cortex.
- Clinical features of Addison's disease are Hypoglycemia, Anorexia, vomiting,
- weakness, hyperkalemia, decreased pubic and axillary hair in female and
- hyperpigmintation
- Treatment of Addison's disease are replacement of glucocorticoids and mineralocorticoids.

SUMMARY

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NOTE

We advise you to read this topic from "physiology book Linda" from page no. 410-422.

Helpful website with Quizzes

- http://education-portal.com/academy/lesson/adrenal-cortex-functions-and-androgens.html#lesson

QUESTIONS

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1. The enzyme associated with the conversion of androgen to estrogen in the growing ovarian follicle is:

A) Desmolase
B) Isomerase
C) Aromatase
D) Hydroxylase

2. Androstenediones are converted metabolically to :

A) testosterone
B) epinephrine and norepinephrine
C) estrogens
D) A&C

3. The Androgenic compounds that produced by adrenal cortex are :

A) DHEA & Androstenedione
B) DHEA & testosterone
C) Androstenedone & testosterone
D) Both A&B

4. Which of the following is correct Regarding Adrenogenital syndrome (Increased synthesis of Adrenal androgens):

A) Decrease muscuilinization in females.
B) Increase of gonadal function in both Males & Females.
C) Late development of axillary and Pubic hair in females.
D) Increase urinary level of 17-Ketosteroids.

1	C
2	D
3	A
4	D

5.Which of the following is correct regarding the symptoms of Addison's disease :

A) Hypoglycemia
B) Hypokalemia
C) Hypertenstion
D) Weight gain

6. Adrenal Insufficiency is a condition in which the adrenal glands do not produce adequate amounts of:

A) Cortisol
B) Androgens
C) Aldosterone
D) All of the above

7. Hypothalamic dysfunction is :

A) Primary cause
B) Secondary cause
C) Tertiary cause

8. Treatment of Adrenal crisis by:

A) digoxin
B) antidepressant
C) Paracetamol
D) Glucocorticoids

5	A
6	D
7	C
8	D

THE END

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If there are any Problems or Suggestions,
Feel free to contact us:

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THANK YOU

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