

## APPLIED ASPECTS OF ADRENAL CORTEX

### EXCESS MINERALOCORTICOID

#### ■ Causes:

##### Primary hyperaldosteronism

(Conn's syndrome)

- Adenoma – Zona Glomerulosa
- Uni or Bilateral adrenal hyperplasia
- Adrenal carcinoma

### SECONDARY HYPERALDOSTERONISM

- Cirrhosis
- Heart failure
- Nephrosis

### FEATURES OF HYPERALDOSTERONISM

- ✚ K<sup>+</sup> depletion
- ✚ Na<sup>+</sup> retention
- ✚ ↑ ECF and blood volume
- ✚ Hypertension
- ✚ Tetany
- ✚ Hypokalemia – Polyuria, hypokalemic nephropathy
- ✚ Alkalosis

### ADDISON'S DISEASE

(THOMAS ADDISON, 1855)

#### Primary adrenal insufficiency

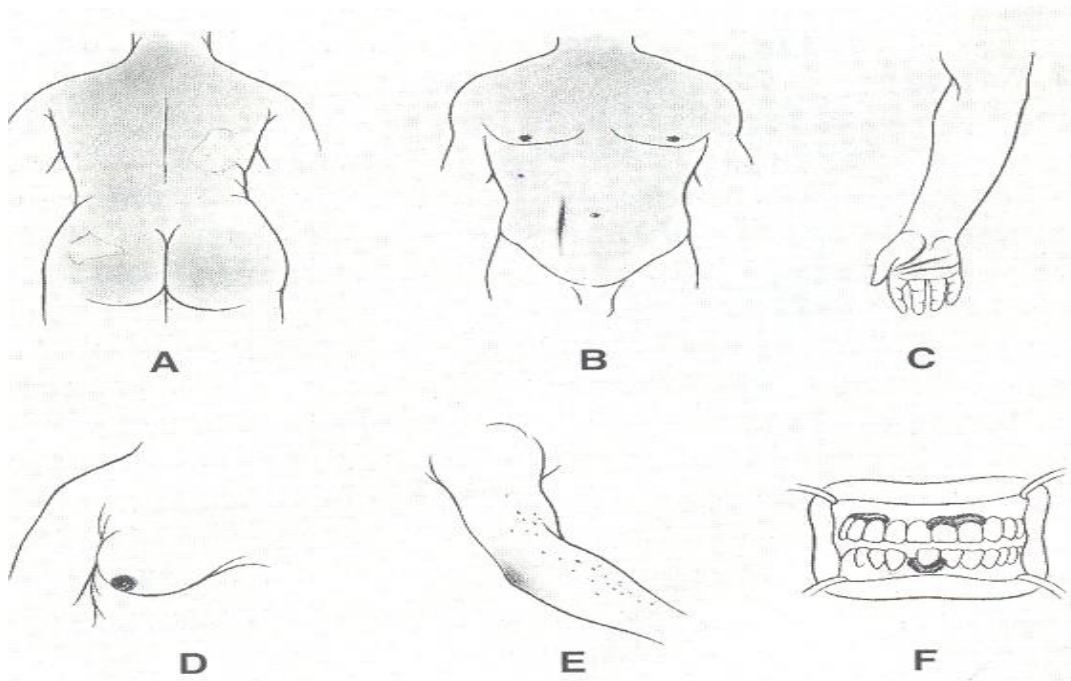
- ✚ Tuberculosis
- ✚ Autoimmunity
- ✚ Cancer

Secondary adrenal insufficiency due to pituitary failure

Tertiary adrenal insufficiency due to hypothalamic failure

## FEATURES OF ADDISON'S DISEASE

- ◆ ↓ ECF volume & hypovolemia
- ◆ Hyponatremia
- ◆ Hyperkalemia
- ◆ Mild acidosis
- ◆ Cardiac output ↓
- ◆ Hypotension, shock, death
- ✱ ↓ Maintenance of blood glucose between meals
- ✱ ↓ Mobilization of proteins, fat
- ✱ Muscular weakness
- ✱ Decreased ability to withstand stress
- ✱ Blood: eosinophilia, lymphocytosis, anemia & neutropenia
- ✱ Pigmentation of skin, gums & mucous membranes





## **Addison's disease:**



- Note the generalised skin pigmentation (in a Caucasian patient) but especially the deposition in the palmer skin creases, nails and gums.

- She was treated many years ago for pulmonary TB. What are the other causes of this condition?

### **Treatment**

- Dexamethazone
- Betamethazone
- Prednisolone

### **Addisonian crisis**

- After adrenalectomy
- Withdrawal of cortisol
- Reduced basal secretion of cortisol

### **Treatment**

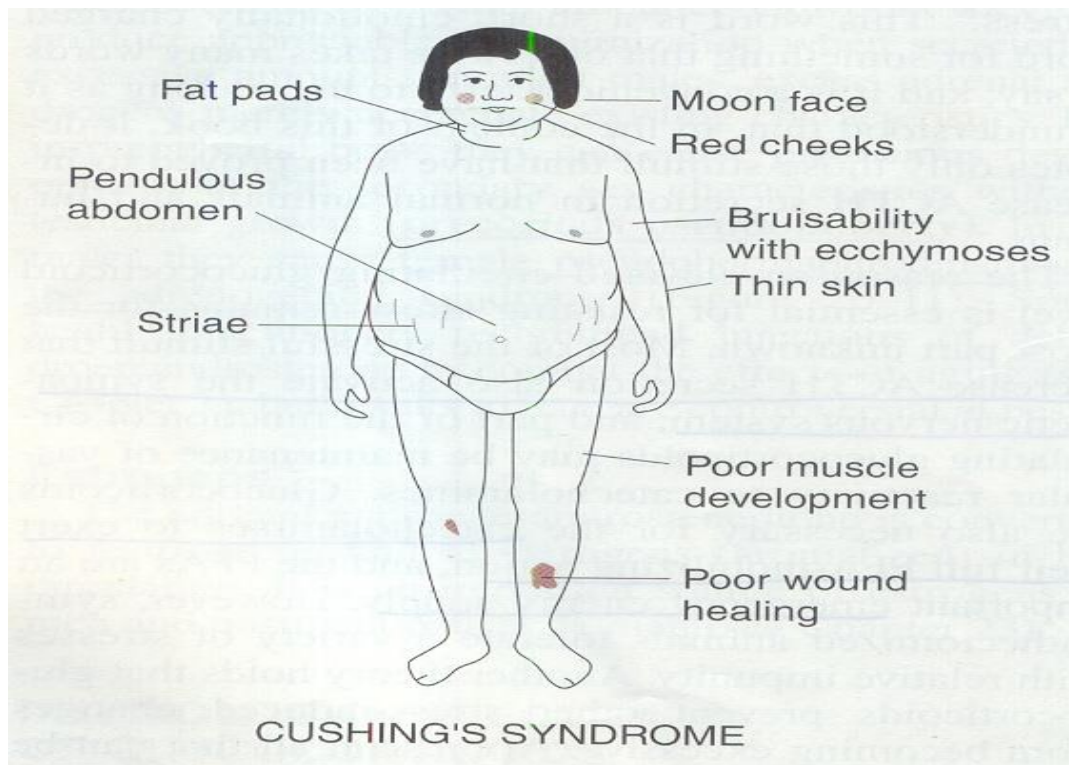
- Glucocorticoids
- Mineralocorticoids

## CUSHING'S SYNDROME (HARVEY CUSHING, 1932)

- ⊕ Cause: Excess secretion of cortisol
- ⊕ Adenoma of anterior pituitary      ACTH
- ⊕ ↑ CRH      dependent
- ⊕ Ectopic ACTH
- ⊕ Adenoma of adrenal cortex      ACTH
- ⊕ Prolonged glucocorticoid      Independent

### Administration

## CUSHING'S SYNDROME



### 1. Carbohydrates

- ☀ Hyperglycemia, glycosuria, ↑ sed resistance to insulin, ↓ glucose utilization by tissues precipitate diabetes mellitus.

### 2. Proteins

- ↑ protein catabolism
- ↓ tissue protein
- Plasma protein unaffected
- Negative nitrogen balance

## STRIAE



6. ↓ protein in bones - Osteoporosis

7. Wounds heal poorly

8. Bruises and ecchymoses

9. Hair - thin and scraggly

10. Blood: eosinopenia, lymphopenia, basopenia,  
neutrophilia, ↑sed platelet count & polycythemia

11. Fat

- body fat redistributed
- buffalo hump
- moon face
- Deposition of fat over abdominal walls leads to rupture of thin skin – purple striae

12. Salt and water retention - Hypertension & oedema

13. Sexual changes

- ↑ sed facial hair (Hirsutism) & acne due to ↑ sed secretion of adrenal androgens.
- Impotency & hypogonadism in males and amenorrhoea in females.

**14. CNS changes:**

- Mental aberration
- ↑ Appetite
- Insomnia
- Euphoria
- Psychoses

**Treatment**

- Removal of tumor

**Drugs blocking steroidogenesis**

- Metyrapone
- ketoconazole

**Inhibits ACTH secretion**

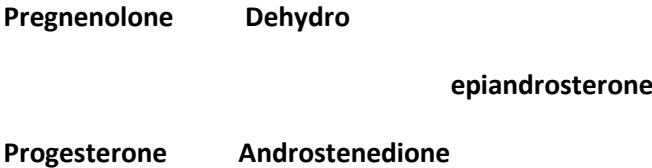
- serotonin antagonists
- GABA transaminase inhibitors

**ADRENOGENITAL SYNDROME**

- It develops due to congenital adrenal hyperplasia in females.
- ↑ sed secretion of androgens with concomitant ↓ sed secretion of gluco & mineralocorticoids.
- Deficiency of 21β & 11β hydroxylase

(salt losing & hypertensive forms)

**Cholesterol**



**21β hydroxylase**

11 – Deoxycorticosterone Testosterone

**11 β hydroxylase**

Corticosterone

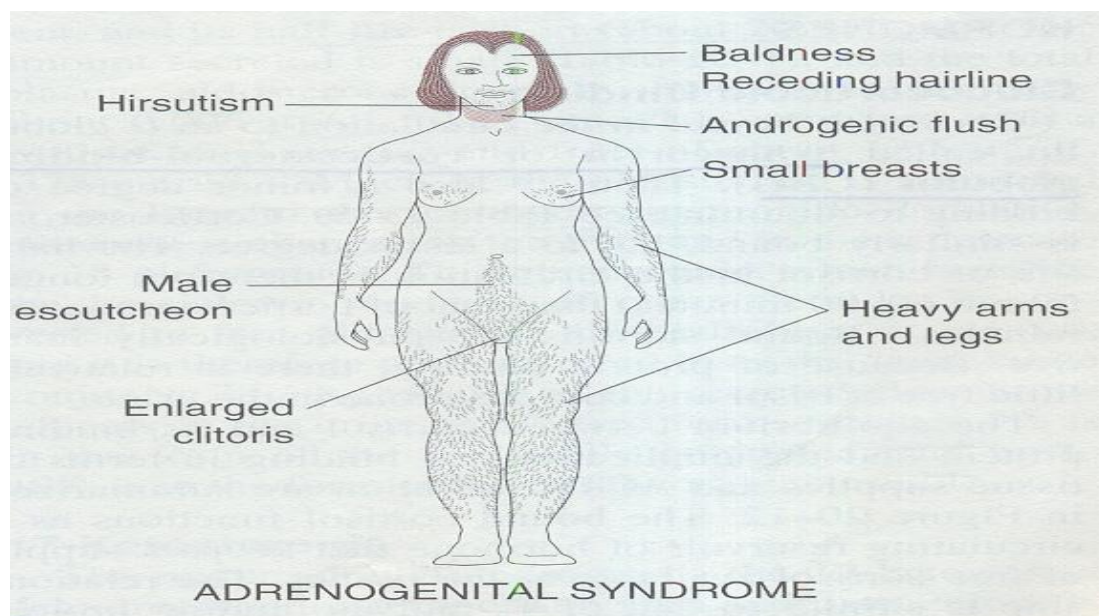
- Androgens exert masculinizing effects & promote protein anabolism and growth.
- Testosterone is the most active androgen; adrenal androgens have < than 20% of its activity.
- Adrenogenital syndrome develops in prepubertal or adult females leading to virilism.
- In adult males – exaggeration of existing masculine characters.

In prepubertal male – precocious pseudopuberty.

#### ADRENOGENITAL SYNDROME

- Masculinizing effects
- Enlargement of clitoris, breast glands remain smaller
- Masculine hair distribution – baldness, recession of hairline, ↑ sed body hair, beard, moustache & hirsutism
- Deeper voice
- Muscle mass ↑ & heavy limbs

#### ADRENOGENITAL SYNDROME



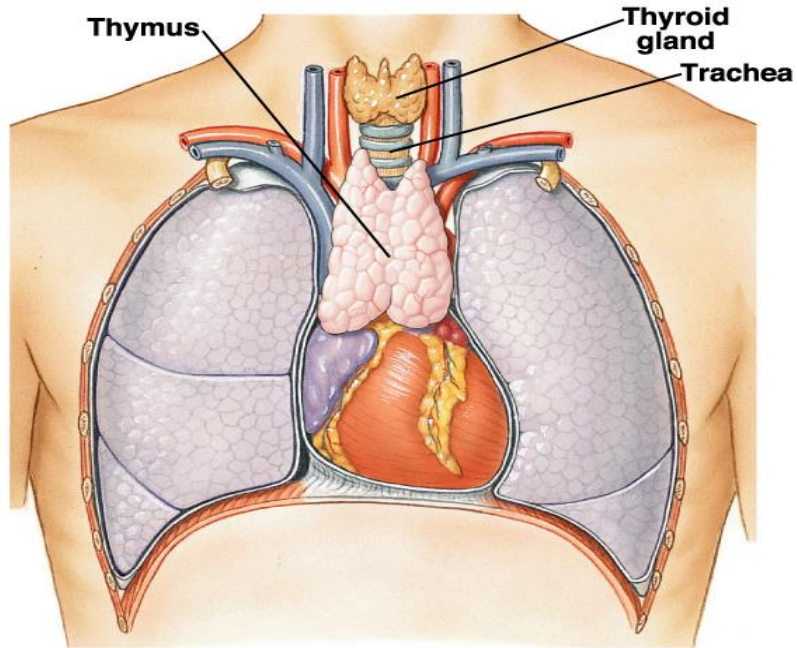
#### Treatment

##### Glucocorticoids

- it repairs the glucocorticoid deficit
- inhibits ACTH secretion

## THYMUS GLAND

- 2 lobed organ located in thorax just above heart – T lymphocytes are formed here.
- Thymus secrete peptide factors that influence the development of T-lymphocytes which include thymosin, thymoprotein & thymulin.



### Functions of thymus gland

- Removal of thymus in animals produce: Lymphopenia & atrophy of lymphoid tissue.
- Failure to produce antibodies.
- Failure to reject foreign tissue transplants.