

HUMAN ANATOMY AND PHYSIOLOGY-II

UNIT-IV

Endocrine system

Disorder of Endocrine Glands



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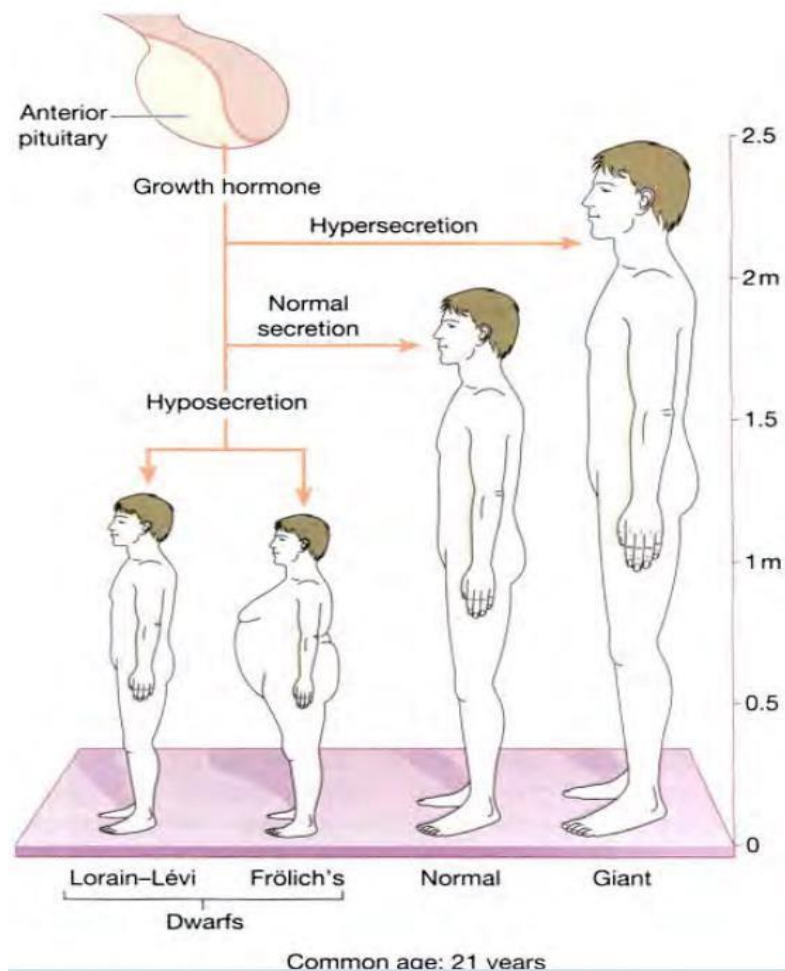
Shaping Lives...
Empowering Communities...

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DISORDERS

Endocrine disorders are commonly caused by tumours or autoimmune diseases and their effects are usually the result of:

- hypersecretion (overproduction) of hormones
- hyposecretion (underproduction) of hormones.



Pituitary Disorders: Hypersecretion and Hyposecretion

- **Diabetes insipidus**

- Hyposecretion of ADH results in inability to conserve water appropriately
- Causes excessive urination, dehydration, thirst

- **Gigantism**

- Hypersecretion of growth hormone in childhood

- **Acromegaly**

- Excessive growth hormone over a long period in adults

- **Pituitary dwarfism**

- Hyposecretion of growth hormone
- Treated by administration of GH throughout childhood

Pituitary Hormone	Hyper-secretion	Hypo-secretion
ACTH	Adrenal hyperplasia (Cushing's disease if pituitary tumour the source)	Secondary adrenocortical insufficiency
GH	Acromegaly (in adults) Gigantism (in children)	Dwarfism
TSH	Secondary hyperthyroidism	Secondary hypothyroidism
PRL	Hyperprolactinaemia	Hypoprolactinaemia (uncommon in isolation)
ADH	Syndrome of inappropriate ADH secretion (SIADH)	Diabetes insipidus

DISORDERS OF THE PARATHYROID GLANDS

These fall into three main categories:

- abnormal secretion of thyroid hormones (T3 and T4)
 - hyperthyroidism
 - hypothyroidism
- goitre — enlargements of the thyroid gland
- tumours

Hyperthyroidism

This syndrome, also known as thyrotoxicosis, arises as the body tissues are exposed to excessive levels of T3 and T4. The main effects are due to increased basal metabolic rate. The main causes are:

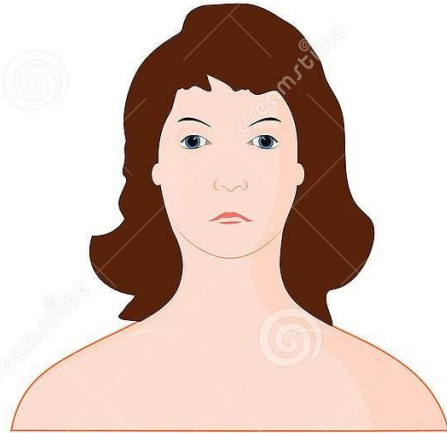
- Graves' disease
- toxic nodular goitre
- toxic adenoma

Hypothyroidism

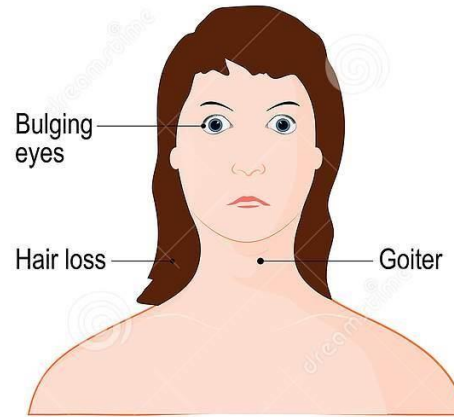
This occurs when there is insufficient T3 and T4 secretion causing:

- cretinism in children
- myxoedema in adults

Graves' disease



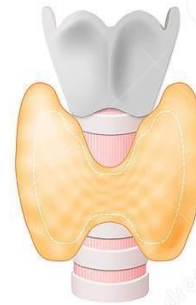
Healthy



Hyperthyroidism



Normal thyroid



Enlarged thyroid



Figure 9.16 Features of cretinism.

Iodine deficiency is well known as cause of cretinism in fetus and newborn, characterized by low birth weight, short stature, mental retardation, deaf, and/or mutism.



Figure 9.17 Facial features of myxoedema.

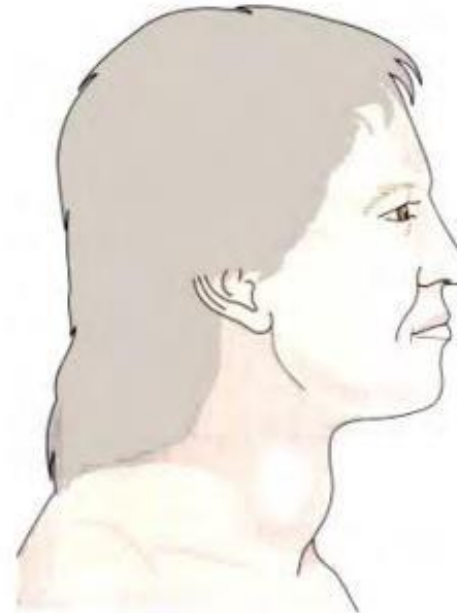


Figure 9.18 Enlarged thyroid gland in simple goitre.

DISORDERS OF THE PARATHYROID GLANDS

Hyperparathyroidism

Excess secretion of parathyroid hormone (PTH), usually by benign tumours of a gland, causes reabsorption of calcium from bones, raising the blood calcium level (hypercalcaemia).

The effects may be:

- formation of renal calculi complicated by pyelonephritis and renal failure
- muscle weakness
- general fatigue
- calcification of soft tissue.

Hypoparathyroidism

Parathyroid hormone (PTH) deficiency causes hypocalcaemia, i.e. an abnormally low level of calcium in the blood. This reduces absorption of calcium from the small intestine and reabsorption from bones and glomerular filtrate.

Low blood calcium causes:

- tetany
- psychiatric disturbances
- cataract (opacity of the lens) and brittle nails.



Figure 9.19 Characteristic positions adopted during tetanic spasms.

Tetany This is caused by hypocalcaemia. There are very strong painful spasms of skeletal muscles, causing characteristic bending inwards of the hands, forearms and feet .

- deficiency of vitamin D or dietary deficiency of calcium

Disorders of Adrenal glands

Adrenal Cortex

- Cushing's syndrome
- Addison's disease
- Hyperaldosteronism
- Syndromes of congenital adrenal hyperplasia (CAH).
- Hirsutism
- Virilization
- Adrenocortical Ca

Adrenal Medulla

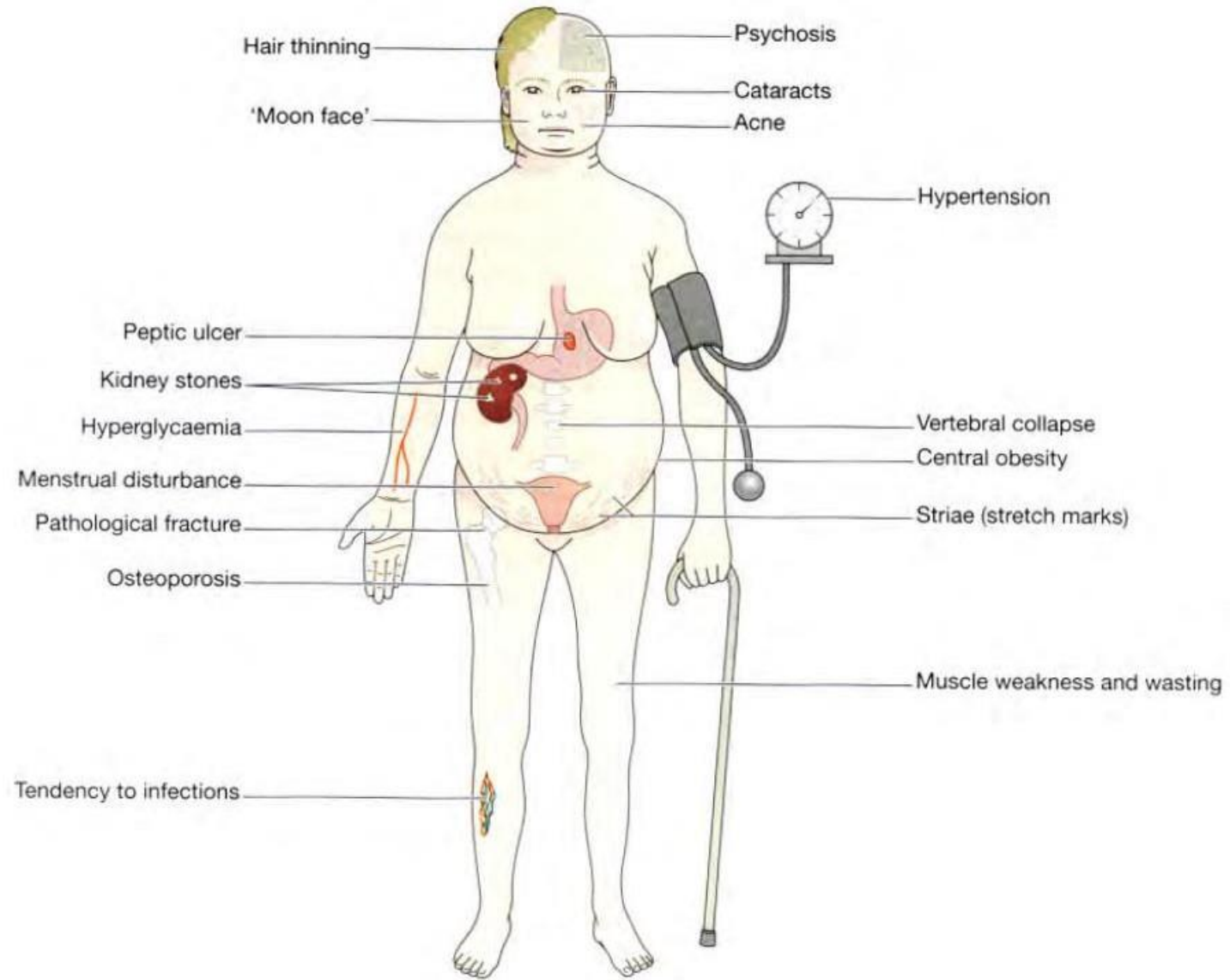
- Pheochromocytoma
- Paragangliomas
- Neuroblastoma

DISORDERS OF THE ADRENAL CORTEX

Hypersecretion of glucocorticoids(Cushing's syndrome)

Cortisol is the main glucocorticoid hormone secreted by the adrenal cortex. Causes of hypersecretion include:

- hormone-secreting adrenal tumours, benign or malignant
- hypersecretion of adrenocorticotrophic hormone (ACTH) by the anterior pituitary
- prolonged therapeutic use of ACTH or glucocorticoids, e.g. prednisolone, in high doses.
- ✓ Hypersecretion of cortisol has a wide variety of effects but they may not all be present. They include:
 - painful adiposity of the face (moon face), neck and abdomen
 - excess protein catabolism, causing thinning of subcutaneous tissue and muscle wasting, especially of the limbs
 - menstrual disturbances
 - formation of renal calculi
 - peptic ulceration.



9.20 The systemic features of Cushing's syndrome.

Hyposecretion of glucocorticoids

Inadequate secretion of cortisol causes diminished gluconeogenesis, low blood glucose, muscle weakness.

Hypersecretion of mineralocorticoids

Primary aldosteronism (Conn's syndrome) This is due to an excessive secretion of mineralocorticoids, independent of the renin-angiotensin-aldosterone system. It is usually caused by a tumour affecting only one adrenal gland.

Secondary aldosteronism

This is caused by overstimulation of normal glands by the excessively high blood levels of renin and angiotensin that result from low renal perfusion or low blood sodium.

Hyposecretion of mineralocorticoids

Hypoaldosteronism results in failure of the kidneys to regulate sodium, potassium and water excretion, leading to:

- ✓ blood sodium deficiency (hyponatraemia) and potassium excess (hyperkalaemia)
- ✓ dehydration, low blood volume and low blood pressure, especially if arteriolar constriction is defective due to deficiency of noradrenaline.

There is usually hyposecretion of other cortical hormones, as in Addison's disease.

Chronic adrenal cortex insufficiency (Addison's disease)

This is due to hyposecretion of glucocorticoid and mineralocorticoid hormones. The most common causes are development of autoantibodies to cortical cells, metastatic tumours and infections. Autoimmune disease of some other glands is associated with Addison's disease, e.g. thyrotoxicosis and hypoparathyroidism. The most important effects are:

- muscle weakness
- gastrointestinal disturbances, e.g. vomiting, diarrhoea, anorexia
- increased pigmentation of the skin,
- tiredness
- hypoglycaemia
- mental confusion
- menstrual disturbances and loss of body hair in women
- electrolyte imbalance, including hyponatraemia, low blood chloride levels and hyperkalaemia
- chronic dehydration, low blood volume and hypotension.

DISORDERS OF THE ADRENAL MEDULLA

Tumours

Hormone-secreting tumours are the main abnormality. The effects of excess adrenaline and noradrenaline.

Phaeochromocytoma

This is a benign tumour, occurring in one or both glands. The secretion of hormones may be at a steady high level or in intermittent bursts.

Neuroblastoma

This is a malignant tumour, occurring in infants and children under 15 years of age. Tumours that develop early tend to be highly malignant but in this condition there may be spontaneous regression.

DISORDERS OF THE PANCREATIC ISLETS

Diabetes mellitus

This is due to deficiency or absence of insulin or rarely to impairment of insulin activity (insulin resistance) causing varying degrees of disruption of carbohydrate and fat metabolism.

Type I, insulin-dependent diabetes mellitus (IDDM)

- ✓ This occurs mainly in children and young adults and the onset is usually sudden. The deficiency or absence of insulin is due to the destruction of β -islet cells.
- ✓ The causes are unknown but there is a familial tendency, suggesting genetic involvement.
- ✓ In many cases an autoimmune reaction has occurred in which autoantibodies to β -islet cells are present. Antibodies to viruses are present in some cases and these may destroy the β -islet cells directly or by an autoimmune mechanism.

Type II, non-insulin-dependent diabetes mellitus (NIDDM)

- ✓ This is the most common form of diabetes, accounting for about 90% of cases.
- ✓ Most patients are obese and it tends to develop in women over 75 years and men over 65 years.
- ✓ The cause is unknown.
- ✓ Insulin secretion may be below or above normal.
- ✓ Deficiency of glucose inside body cells may occur when there is hyperglycaemia and a high insulin level.
- ✓ This may be due to changes in cell membranes which block the insulin-assisted movement of glucose into cells (insulin resistance).

Secondary diabetes

This may develop as a complication of:

- ✓ acute and chronic pancreatitis
- ✓ some drugs, e.g. corticosteroids, phenytoin, thiazide diuretics
- ✓ secondary to other hormonal disturbances involving hypersecretion of e.g. growth hormone, thyroid hormones, cortisol, adrenaline
- ✓ pregnancy (gestational diabetes).

Gestational diabetes

- ✓ This develops during pregnancy and usually disappears after delivery; however, diabetes often recurs in later life.
- ✓ Raised blood glucose levels during pregnancy predispose to the birth of excessively large babies and also to stillbirths and deaths shortly after birth.