

The Pituitary Gland

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The pituitary gland is in close anatomic relation to median eminence, a part of hypothalamus.

Pituitary gland consists of

- Adenohypophysis: Anterior lobe
- Neurohypophysis: Posterior lobe

Adenohypophysis: 3 parts

- Pars distalis
- Pars intermedia
- Pars Tuberalis

Neurohypophysis: 3 parts

- Median eminence
- Infundibular stem
- Infundibular process

Adenohypophysis is influenced by hormones from hypothalamus through hypothalamohypophyseal portal tract

Neurohypophysis by neurons-hypothalamo-hypophyseal neural tract which convey hormones directly from hypothalamic nuclei for storage in the posterior lobe

Pituitary hormones

Anterior lobe hormones

1. Thyroid stimulating hormone
2. Adrenocorticotrophic hormone
3. Growth hormone
4. Follicle stimulating hormone
5. Leuteinizing hormone
6. Prolactin

Posterior lobe hormones

1. Vasopressin
2. Oxytocin

Anterior pituitary

Histology

Two major cell types are found in anterior pituitary

Chromophils-75%, chromophobes-25%

80% of chromophils are Acidophils and are of two types

- Somatotrophs-Growth hormone
- Mammotrophs-Prolactin

Basophils-20% of chromophils and of 3 types

- Gonadotrophs-LH and FSH
- Thyrotrophs-TSH
- Corticotrophs-ACTH

Growth hormone (Somatotrophin or somatotrophic hormone)

Source-Acidophils of anterior lobe

Control-GH releasing hormone(GHRH) and Growth hormone inhibiting hormone(GHIH)

Stimuli that increases GH secretion

- Substrate deficiency in the cell.eg:Hypoglycemia,moderate to severe exercise,fasting
- Oestrogen,androgens
- Glucagon
- Emotional and stressful stimuli

Stimuli that decrease GH secretion

Mediated by GHIH or somatostatin

Factors-increase in GH by negative feedback ,glucocorticoids,Glucose, free fatty acids ,old age

Actions of GH

- **Stimulation of growth of bone, cartilage and connective tissue mediated by somatomedins**
Before epiphyseal closure it increases the thickness of end-plate accounts for the increase in linear skeletal growth
After epiphyseal closure bone thickening can occur through periosteal growth
- **Effect on protein and mineral metabolism**
Protein anabolism,increases Ca⁺ absorption from GIT,Decreases Na⁺,K⁺,Ca⁺ and phosphorus excretion from Kidneys
- **Effect on carbohydrate metabolism**
Increase hepatic glucose output
Decrease glucose uptake by adipose tissue and skeletal muscle
- **Effect on fat metabolism**
Catabolic effect ,mobilize fat from adipose tissue,increases circulating FFA
Ketogenic-oxidation of fatty acids to ketone bodies
- **On kidneys**
Removal of anterior pituitary causes decrease in kidney size,GFR decreases,renal blood flow decreases
- **On thymus**-increases the growth
- **Increases milk production**

Applied Physiology

Hyposecretion of Growth hormone- Dwarfism

Causes

Reduction in GH secretion in infancy or early childhood causes dwarfism. It occurs because of the following reasons:

1. Tumor of chromophobes, Deficiency of GH-releasing hormone secreted by hypothalamus, Deficiency of somatomedin, Atrophy or degeneration of acidophilic cells in the anterior pituitary, Panhypopituitarism

Signs and symptoms

- Stunted skeletal growth. Maximum height -3 feet
- But the proportions of different parts of the body are almost normal. Only the head becomes slightly larger in relation to the body
- Pituitary dwarfs do not show any deformity and their mental activity is normal with no mental retardation
- Reproductive function is not affected, if there is only GH deficiency. However, during panhypo- pituitarism, the dwarfs do not obtain puberty due to the deficiency of gonadotropic hormones

Hypersecretion

- Gigantism in children (before epiphyseal closure)
- Acromegaly in adults (after epiphyseal closure)

Gigantism

- Tall stature-7-8 feet long
- Bilateral gynecomastia
- Large hands and feet
- Coarse facial features, loss of libido or impotence
- Bitemporal hemianopia
- Headache
- Hyperglycemia

Acromegaly

- Acromegalic or **gorilla face**: Face with rough features such as protrusion of supraorbital ridges, broadening of nose, thickening of lips, thickening and wrinkles formation on forehead and **prognathism** (protrusion of lower jaw)
- Enlargement of hands and feet, Kyphosis, Thickening of scalp. Scalp is also thrown into
- folds or wrinkles like **bulldog scalp**

- Overgrowth of body hair, Enlargement of visceral organs such as lungs, thymus, heart, liver and spleen
- Hyperactivity of thyroid, parathyroid and adrenal glands, Hyperglycemia and glycosuria, resulting in diabetes mellitus
- Hypertension x. Headache
- Visual disturbance (**bitemporal hemianopia**)

Posterior pituitary Hormones

- Antidiuretic hormone or vasopressin
- Oxytocin

Anti Diuretic Hormone

Source: Hypothalamic hormone synthesised in the cells of supraoptic nucleus and small quantity from paraventricular nucleus and is stored in nerve endings in post. pituitary

Actions

Antidiuretic hormone has two actions:

1. Retention of water

ADH increases water reabsorption in distal convoluted tubule and collecting duct by regulating the **water channel proteins** called **aquaporins**

2. Vasopressor action.

In large amount, ADH shows vasoconstrictor action. Particularly, causes constriction of the arteries in all parts of the body. Due to vasoconstriction, the blood pressure increases.

Stimulants for ADH secretion:

1. Decrease in the extracellular fluid (ECF) volume
2. Increase in osmolar concentration in the ECF.

OXYTOCIN

Source of Secretion

Oxytocin is secreted mainly by paraventricular nucleus of hypothalamus. It is also secreted by supraoptic nucleus in small quantity and it is transported from hypothalamus to posterior pituitary through the nerve fibers of hypothalamo-hypophyseal tract.

Action

- Milk ejection - Neuroendocrine reflex - Suckling → stimulation of tactile receptors in areola of breast → activates somatoasthetic neural pathways → signal to paraventricular nucleus in hypothalamus → Reflex secretion of oxytocin
- Contraction of smooth muscles of uterus during labour
In males it facilitates transport of sperms