PITUITARY GLAND

The Endocrine system is divided into :

- **Endocrine organs:** which are entirely dedicated to production of hormones e.g pituitary, thyroid , parathyroid & adrenal .
- **Endocrine components:** in clusters in organs having mixed functions, e.g. pancreas, ovary & testes.
- **Diffuse endocrine system :**comprising scattered cells within organs or tissues acting locally on adjacent cells without entry into blood stream (Paracrine)

Classificationof Hormones

- **Hormones that trigger biochemical signals upon interacting with cell surface receptors:** Leads to an increase in intracellular molecules,termed second messenger (cAMP) , production of mediators from membrane phospholipid , elevation in the intracellular calcium which might lead to: proliferation differentiation, survival, functional activity of the cells.
  - example : **1-peptide hormones: Growth hormones, and insulin.**
    2-small molecules: epinephrine.
- **Hormones that diffuse across the plasma membrane and interact with intracellular receptors:**
  - example:**Lipid soluble hormones include: steroids (estrogen ,progesterone, glucocorticoids), retinoids , thyroxine.**

Disease divided into :

- Diseases of overproduction of secretion (Hyperfunction)
- Diseases of underproduction (Hypofunction)
- Mass effects (Tumors)

anatomy

The pituitary lies in sella turcica ,& **weighs about 0.5 gm**. It is connected to the HYPOTHALAMUS through its stalk, and composed of :

- ADENOHYPOPHYSIS
  - (80 %) developed from Rathke s pouch .Its blood supply is through venous plexus from hypothalamus. It is controlled under Hypothalamic Hypophyseal feed back control.
    Produce GH,PROLACTIN,ACTH,FSH,LH,TSH
    *GH ,PROLACTIN → works on specific cells . ACTH → adrenal gland .
    LH,FSH →ovary . TSH→thyroid gland.
- NEUROHYPOPHYSIS
  - developed from the floor of the third ventricle &consists of modified glial cells & axons from cell bodies in hypothalamus.
    It has its own blood supply. Produce oxytocin &ADH

histology

ADENOHYPOPHYSIS **:mixture of cells *** or we can say mixture of colors beacuse pituitary adenoma or carcinoma is composed of one typer or color of cells **:**

- The pink acidophils: secrete growth hormone (GH) and prolactin (PRL)
- The dark purple basophils :secrete corticotrophin (ACTH), thyroid stimulating hormone (TSH), and gonadotrophins follicle stimulating hormone luteinizing hormone (FSH and LH)
- The pale staining chromophobes: have few cytoplasmic granules, but may have secretory activity.

NEUROHYPOPHYSIS:shown here resembles neural tissue, with glial cells, nerve fibers, nerve endings, and intra axonal neurosecretory granules.
The hormones vasopressin (antidiuretic hormone, or ADH) and oxytocin made in the hypothalamus (supraoptic and paraventricular nuclei) are transported into the intra axonal neurosecretory granules where they are released.

CELLS & SECRETIONS :

Anterior pituitary (Adenohypophysis):
1-Somatotrophs from acidophilic cells→ Growth H.
2-Lactotrophs from acidophilic cells→ Prolactin
3-Corticotrophs from basophilic cells →ACTH, POMC derived peptides.
4-Thyrotrophs from pale basophilic cells→ TSH
5-Gonadotrophs from basophilic cells→ FSH, LH

Posterior pituitary (Neurohypophysis):
1-Oxytocin
2-ADH

pathology

HYPERPITUITARISM

- causes
  - **In most cases, excess is due to ADENOMA arising in the anterior lobe.**
    Less common causes include :
    * Hyperplasia
    * Carcinoma
    * Ectopic hormone production
    * Some hypothalamic disorders

PITUITARY ADENOMA

- Incidence of pituitary adenomas:
  - -10 % of all intracranial neoplasms
    -25 % are incidental
    -3 % occur with MEN syndrome
    -Most occur between 30- 50 years of age
- Behaviour of pituitary adenomas :
  - 1-Primary pituitary adenomas usually benign.
    2-Radiological changes in sella turcica
    3-May or may not be functional(20 %). If functional (80 %), the clinical effects are secondary to the hormone produced.
    3-More than one hormone can be produced from the same cell (monoclonal)
- clinical features:
  - 1-Symptoms of hormone production
    2-Visual field abnormalities (pressure on optic chiasma above sella tursica)
    3-Elevated intracranial pressure (blockage of CSF flow):
    Headache , nausea , vomiting
    4-Hypopituitarism (result from pressure on adjacent pituitary): Diabetes insipidus
    5-Cranial nerve palsy (invasion to brain).
    *point 2,3,4,5 are related to the mass effect of the adenoma
- Morphology :
  - 1-Well circumscribed, invasive in up to 30%
    2-Size 1 cm. or more, specially in nonfunctioning tumor
    3-Hemorrhage & necrosis seen in large tumors .
    Microscopic picture:
- Microscopic picture:
  - -Uniform cells, **one cell type** (monomorphism)
    -Absent reticulin network
    -Rare or absent mitosis
- 1- most common presentation of adenoma isPRL cell adenoma ,30%
  2- nonfunctioning adenoma ishas a prevelence of 20-25%
  3-least common presentation is TSH cell adenoma , 1%
- Types of Pituitary Adenomas:
  - Previously classified according to histological picture
    - e.g:Acidophilic Adenoma
  - Now according to immunohistochemical findings & clinical picture
    - e.g:
      - PROLACTINOMA :
        - -30 % of all adenomas, chromophobe or w. acidophilic
          -Functional even if microadenoma*is less than 1cm , but amount of secretion is related to size
          -Mild elevation of prolactin does NOT always indicate prolactin secreting adenoma !
          **cut point between microadenoma and macroadenoma is 1cm
          -Any mass in the suprasellar region may interfere with normal prolactin inhibition → ↑ Prolactin
          (STALK EFFECT)
        - Other causes of ↑ prolactin include :
          - -estrogen therapy
            -pregnancy
            -certain drugs, e.g reserpine (dopamin inhibitor).
            -hypothyroidism
            -mass in suprasellar region ?
        - Symptoms :
          - -Galactorrhea
            -Amenorrhea
            -Decrease libido
            -Infertility
        - Treatment:
          - Bromocreptine (dopamine agonist);cause shrinkage of neoplasm & regression of hyperplasia in most causes.
      - Growth hormone secreting adenoma :
        - -40 % Associated with GNAS 1 gene mutation
          -Persistent secretion of GH stimulates the hepatic secretion of insulin like growth factor I (IGF- I) → many of clinical effects
          -Initial investigation : measurement of GF & IGF- I which is increased.
          -Confirm by failure to suppress GH production in response to an oral load of glucose
        - Structure :
          - Composed of granular ACIDOPHILIC cells and may be mixed with prolactin secretion.
        - Symptoms :
          - May be delayed so adenomas are usually large
            Produce GIGANTISM (children) or ACROMEGALLY (adults).
            Diabetes, arthritis, large jaw & hands, osteoporosis , ↑ BP, HF etc
      - Corticotroph cell adenoma:
        - -Usually microadenomas
          -Higher chance of becoming malignant
          -chromophobe or basophilic cells
          -Functionless or Cushing s Disease (↑ ACTH)
          -Bilateral adrenalectomy or destruction may result in aggressive adenoma:
          Nelsons Syndrome
          -↑ ICP
      - Non functioning adenoma:
        - 20 % silent or null cell,nonfunctioning & produce mass effect only
      - Gonadotroph producing LH &FSH:
        - (10 15 %)Function silent or is minimal , late presentation mainly mass effect produced.
          Produce gonadotrophin ą subunit, β FSH & β LH.
      - TSH producing :
        - (1 %) rare cause of hyoerthyroidism
      - Pituitary carcinoma:
        - Extremely rare, diagnosed only by metastases.

HYPOPITUITARISM :

- -Loss of > 75 % of ant. Pituitary →Symptoms
  -Congenital or acquired, intrinsic or extrinsic
- Acquired causes include :
  - 1-Nonsecretory pituitary adenoma
    2-SHEEHAN S SYNDROME
    3-Ischemic necrosis e.g. sickle cell anemia, DIC
    4-Pituitary apoplexy
    5-Iatrogenic by radiation or surgery
    6-Autoimmune (lymphocytic) hypophysitis
    7-Hypothalamic mass
    8-Inflammatory e.g sarcoidosis or TB
    9-Empty Sella Syndrome :
    Radiological term for enlarged sella tursica , with atrophied or compressed pituitary.
    May be primary due to downward bulge of arachnoid into sella floor compressing pituitary.
    Secondary is usually surgical.
    10-Infiltrating diseases: in adjacent bone e.g. Hand Schuller- Christian Disease
    Metastatic tumors
    11-Craniopharyngioma
- Symptoms :
  - -Dwarfism (Pituitary Dwarf) in children.
    -Effect of individual hormone deficiencies.
    - Amenorrhea & no lactation
    -Loss of MSH→ Decreased pigmentation

Craniopharyngioma

-1- 5 % of intracranial neoplasms
-Derived from remnants of Rathke s Pouch
-Suprasellar or intrasellar ,often cystic with calcification
-Children or adolescents most affected
-Symptoms may be delayed ≥ 20 yrs(50%)
-Symptoms of hypofunction or hyperfunction of pituitary and /or visual disturbances, diabetes insipidus
-Benign & slow growing

POSTERIOR PITUITARY SYNDROMES:

- ADH deficiency : Diabetes Insipidus
  - Polyuria, polydipsia, hypernatremia & dehydration.
    Urine is dilute, due to inability to reabsorb water from the collecting tubules.
  - causes: Head trauma, tumors & inflammations in pituitary or hypothalamus etc
- Syndrome of inappropriate ADH secretion (SIADH):
  - -Part of paraneoplastic Syndrome :
    Small Cell CA of Lung
    -Causes excessive resorption of water hyponatremia , cerebral edema.
- Abnormal oxytocin secretion
  - Abnormalitis of synthesis & release have not been associated with any significant abnormality.