Anatomy (I)

المحاضرة الأولى

→ Brain diencephalon ⇝ Hypothalamus, thalamus and epithalamus.

→ The hypothalamus affects the ndocrine system by 2 ways:-

1. Secretions of two hormons ⇝ ADH and oxytocin.

2. controlling the secretion of the pituitary hormons.

→ Pituitary gland = Hypophyseal ⇝ Hypothalamus بنطوز تحت ال.

→ Some gland are only endocrine glands ⇝ pituitary, pineal, thyroid, Parathyroid and adrenal/suprarenal.

→ other glands have other Functions :-

1. Hypothalamus ⇝ Brain Function. 2. Thymus ⇝ neural Function.

3. pancreas ⇝ exocrin Function.

→ Hormons could be :- 1. lipid soluble

- Bind to cytoplasmic receptors. ↓ or inter the nucleus inducing genetic effects.

2. Water soluble. ↓

- Bind to extracellular receptors.

→ The endocrine hormons may NOT be able to effect nearby cells and the secreting cell.

→ PITUITARY :-

- it is connected to the brain (Hypothalamus) by a stalk called the infundibulum.

- Has two lobes :- 1. adenohypophysis 2. neurohypophysis.

- it is located in the hypophyseal Fossa (sella turcica).

↳ in the Phenoid bone.

- Anterior ⇝ Sphenoid sinks.

- Inferior ⇝ the body of the sphenoid (sinks.)

- posterior ⇝ dorsum sellae, basilar artery, pons

- superior ⇝ Diaphragma Sellae.

opining. ↓ ↳ ACts as a roof with a central aperture that allows the passage of the infundibulum, it separates the PG From overlying optic chiasma.

- optic chiasma → where the left and right optic nerves cross each other before reaching the orbits.
    - → Any adenoma or carcinoma in this place will affect the vision.
- Lateral → cavernous sinus → sphinoid bone.
- No medial relation.

Meninges

- inner → Pia
- middle → arachnoid
- outer → Dura
    - embedded in the brain to the spinal cord.
    - in the spinal cord it has on layer
    - while in the brain it has 2 layers.
        - external
        - internal

فيه بينهم مساحة وفيها المساحة فيها veinous network

→ اسموها cavernous sinus.

→ The cavernous sinus is risponsible for orbital drainage, carotid artery and ophthalmic artery.

→ Endoscopic Transnasal:

→ The most common procedure (عملية) for removing pituitary tumors.

→ The neurosurgeon reaches the tumor through the nasal passages (ممرات) and the sphenoid sinus → it is called transphenoidal.

→ Avoid important brain structures by accessing the pituitary gland from underneath the brain.

→ Leaves no visible scar, minimizers the resk of complications and enables faster recovery.

→ craniotomy → surgical opening into the skull.

→ in some serious cases (malignant carcinoma), the endoscopic is not effective and surgery is the solution.

→ The Pharynx join with three parts forming: nasopharyngeal (anterior to PG), oropharyngeal and laryngopharyngeal.

→ STRUCTURE AND ~~ORIGIN~~ ORIGIN :-

PG has two lobes

Adenohypophysis

- Anterior lobe.
- Pars tuberalis (wrap when the Rathcks pouch attaches to the infundibulum)
- pars intermedia.
- pars distalis.

Neurohypophysis

- posterior lobe.
- infundibular stalk.
- pars nervosa.
- connected to the hypothalamus by a tail called infundibulum.

→ PITUITARY ORGANOGENESIS

- Both lobes of PG are originated From thickened ectoderm.
- Begins during week 4 of Feral development.
- oral ectoderm ⇝ hypophyseal placode ⇝ Rathcke's pouch (upward evagination that extends towards the neural ectoderm.

At the same time

- Downward extension of the ventral diencephalon ⇝ forms the posterior lobe.
- Both lobes connect to form the composite structure of the adult pituitary.
- During week 6-8 of Rathke's pouch constricts at its base and eventually separates altogether From the oral epithelium.

→ Hypothalamus has many nuclei, some of them are responsible of producing ADH and oxytocin. these hormons transmit through the axons of the infundibulum's neurons to the pars nervosa ⇝ we call this way Hypothalamo-Hypophyseal tract.

- it is short.

Hypothalamus

releasing and inhibitory secretion. → effect on the anterior lobe.

its own hormons → effect on the posterior lobe.

Anatomy (2)

المحاضرة الثانية

↳ the arch of the aorta and the brachiocephalic artery ↳ common carotide artery ↳ the internal carotid artery.

pituitary gland: الـ branches تبعها

superior hypophyseal artery — inferior hypophyseal artery.

superior hypophyseal artery → posterior / Anterior

→ circel around the lowest part of the hypothalamus and the hormons mamaging happens here.

↳ The inferior hypophyseal is a branch of the cavernous portion.

↳ The superior hypophyseal is a branch of intracranial portion.

↳ superior hypophyseal artery ↳ primary plexus
Secondary plexus ↳ Hypophysal portal veins ↲

1. SECRETIONS OF THE HYPOTHALAMUS

↳ The two nuclei of hypothalamus (supraoptic and paravintricular) Make two hormons ↳ ADH and oxytocin ↳ Delivered through the axons and will be stored in the pars nervosa ↳ nerve impulses ↳ Released to the blood.

↳ They are transmitted by thee axonis in hypothalamus-hypophyseal tract (portal circulation).

2. Releasing and inhibiting hormons:-

↳ Mainly the hormons in the anterior pituitary gland.

↳ These hormons must Firstly reach the adenohypophysis instead of going to the systemic circulation.

↳ Veins ↳ brache again to Form the secondary plexus ↳ the hormons reach the adenohypophysis.

↳ Hormons:- TRH, GnRH, GHRH, CRH, PIH, GHIH.

↳ After that the capillaries will Form normal veins and go back to the systemic circulation. Hypophyseal Vein. ↲

↳ Portal circulation can also Found in liver and Kidney.

NEUROHYPOPHYSIS (Posterior pituitary)

↳ Nural tissue. ↳ collection of unmyelinated axons with (glia cells) ↳ called pituicytes.

↳ Consists of pars nervosa and the infundibular stalk.

↳ DOSN'T contain the cells that synthesize its own hormones.

↳ carrier proteins: neurophysin I and II.

ADENOHYPOPHYSIS (Anterior pituitary)

1. ↳ ONLY Hormonal (secretory)

↳ epithelial cells.

↳ pars distalis, pars intermedia, and pars tuberalis.

~~Lec~~ Anatomy (3)

→ ADENOHYPOPHYSIS - MAJOR CELL TYPES

↳ These cells are found mainly in pars distalis, with ~~there~~ has the main function.

↳ Cells:-

1. somatotrophs:- 50%

↳ Hormons:- A. somatotrophin (GH)

B. A 22-KDa protein

↳ Function:- stimulates growth in epiphyseal plates of long bones via insulin-like growth Factors (IGFs) produced in liver.

2. Lactotrophs (mammotrophs):- 15-20%

↳ Hormons:- A. Prolactin (PRL)

B. a 225 KDa protein.

↳ Function:- promotes milk secretion.

3. Gonadotrophs (10%)

↳ Hormones:- A. Follicl-stimulating hormone (FSH).

B. Luteinizing hormone (LH).

C. ICSH in male. D. 28-KDa glycoprotein dimer.

↳ Functions:-

-FSH → promotes ovarian follicle development and estrogen secretion in women and spermatogenesis in men.

-LH → promotes ovarian follicle maturation and progesterone secretion in women and interstitial cell androgen secretion in men.

4. Thyrotrophs:- 5%

↳ Hormones:- A. Thyrotrophin (TSH).

B. 28-KDa glycoprotein dimer.

↳ Function:- stimulates thyroid hormone synthesis, storage, and liberation (ثم يرا).

5. corticotrophs:- 15-20%

↳ Hormons:- A. Adrenal corticotrophin (ACTH).

B. 4-KDa polypeptide D. lipoprotein (LPH);

↳ Function:- Stimulates secretion of adrenal cortex hormons, helps regulate ~~mid~~ metabolism.

↳ POMC in pars distalis → ACTH and ~~B-lipotrophin~~ B-lipotrophin (B-LPH)

PARS DISTALIS

↳ The biggest. ↳ Has a thin fibrous capsule.

↳ cords of well-staind endocrine cells interspersed with fenestrated capillaries (the 2nd set of portal system) and supporting reticular connective tissue.

↳ chromophils → secretory cells that stores the hormone in cytoplasmic granules (basophils and acidophils) and have many vessels around.

↳ Acidophils → somatotrophs and lactotrophs.

↳ Basophils → corticotrophs, gonadotrophs, and thyrotrophs.

↳ chromophobes → No strain and less vessels.

PARS TUBERALIS

↳ Most of the cells of ~~pars~~ gonadotrophs.

↳ warps (تلتف) the infundibulum.

↳ Has less cells.

PARS INTERMEDIA

↳ Between pars distalis and pars nervosa.

↳ Contains:- 1. Basophils (corticotrophs).
2. chromophobes. 3. small, colloid-filled cysts ⇝ Derived from the lumen of the embryonic hypophyseal pouch.

↳ Best-developed and active during Fetal life.

↳ Unique Function:- Express POMS ⇝ MSH*, γ-LPH and β-endorphin.

Different from the pars distalis. ↵

* MSH ⇝ Melano-stimulating hormone.

↳ Remnants of the embryonic hypophyseal pouch's lumen are usually present in this region as colloid-filled cysts.

HYPOTHALAMIC HORMONS TO THE ADENOHYPOPHYSIS

↳ only two inhibitory hormones

Dopamin
↓
inhibits release
of Prolactin (PRL)

somatostatin
↓
inhibits release
of both somatotropin
1. and 2.
(GH) & TSH

↳ Releasing hormones:-

1. Thyrotrophin-releasing hormone (TRH).
2. Gonadotrophin-releasing hormone (GnRH)
   - FSH
   - LH
3. Growth-hormone releasing hormone (GHRH.)
4. corticotrophin-releasing hormone

Anatomy (5)

1 → STROMA:-

↳ A double capsule:-

The outer ↓ Pretracheal Fascia → فوصل

The inner

↳ CT septa:- Deviding the gland into incomplete lobes and lobules.

↳ Reticular Fibers: A network supporting the thyroid parenchyma.

2 → PARENCHYMA:-

↳ composed of Follicles.

↳ The Follicles are surrounded by networ of Fenestrated blood capillaries.

→ colloid ↳ أي مادة متجانسة عبتتكون من جزيئات كبيرة لنفس المادة.

↳ They contain a gelatinous {acidophilic} material in their lumina called colloid.

↳ the Follicles are lined by cuboidal cells of two types

Follicular cells

parafollicular cells.

- Follicular Cells ↳ synthesis and secretion of thyroid hormons (T_3 , T_4)

↓ كميته بالدم أكثر من ال T_3.

↳ shape ↳ simple cuboidal cells.

↳ Nucleus ↳ central and rounded.

↳ cytoplasm ↳ basophilic

↓ protein synthesis cells ← لأنها بتصنع Thyroid hormones لأنه بتعمل

∴ Basophilic لأنها بتحتوي على RER وهي شغيلة

↳ The cells change their shape according to the degree of activity:-

Active

columnar

squamous.

→ synthesis of Thyroid Hormons:-

1. synthesis of thyroglobulin (Glycoprotein):-

A. The protein part is synthesized from the amino acids tyrosine by the rough endoplasmic reticulum.

B. The golgi apparatus adds carbohydrate to the protein to form thyroglobuli and packed into secretory vesicles.

C. The secretory vesicles are discharged into the lumen of follicle by exocytosis where thyroglobulin contributes in the formation of the colloid.

2. Uptake of iodide:- The Follicular cells trap the iodide from the cappillaries

↳ oxidation into iodine ↳ released to the follicular lumen.

3. Iodination of thyroglobulin:- takes place in the colloid to form Monoiodotyrosine and diiodotyrosine

4. Formation of T_3 and T_4 → by coupling reaction in the colloid, where they are stored in the lumen of the of the Follicle.

5. Release of T_3 and T_4:-

↳ TSH → endocytosis of the colloid in endocytotic vesicles by the follicular cells → fusion of the vesicles with lysosomes → Hydrolysis → release of T_3 and T_4 to the blood stream.

→ T3 ↳ Diiodotyrosine + Monoiodotyrosine.

→ T4 ↳ Diiodotyrosine + diiodotyrosine.

→ Follicular Cells ↳

- Basally ↳ rER

- Apically ↳

1. supranuclear Golgi ↳ secretory vesicles ← بتكون

2. secretory vesicles containing thyroglobulin

3. Microvilli ↳ Enzymes (peroxidase) بتزود الـ surface area الـ Enzymes
إلي مسؤول عن الـ oxidation والـ coupling.

4. Endocytotic vesicles and lysosomes.

→ The thyroid gland is unique gland which stores its hormone precursor at a colloid extracellular and Not intracellular.

→ it is stored for 2-3 monthe, and because of that the decreasing in the thyroid hormones start after 2-3 monthes.

→ secretory granule store the protein inside itselfe ↳ so the thyroid granule dosen't have secretory granules.

- Parafollicular cells (C cells)

↳ synthesis and secretion of calcitonin
Decrease blood Ca level ↵

↳ cytoplasm → pale (فاتح) (clear cells).

↳ Their basal surface rest on the follicular basment membrane but their apical surfaces Never reach the lumen of the Follicle.

E ↳ in Electrone microscope the parafollicular cells apperes polypeptides secreting cells.

↳ Moderate amount of organelles because of it it appeares pale.

↳ infra nuclear golgi

↳ secretory granules are small and basal → عشان تطلع محتوياتها على الـ capillaries.