PITUITARY GLAND DISORDERS

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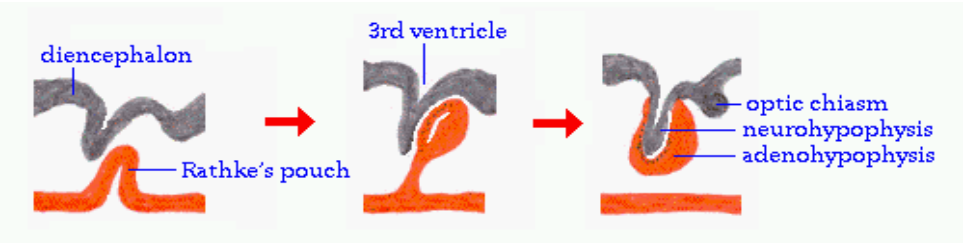
INTRODUCTION

Community Medicine

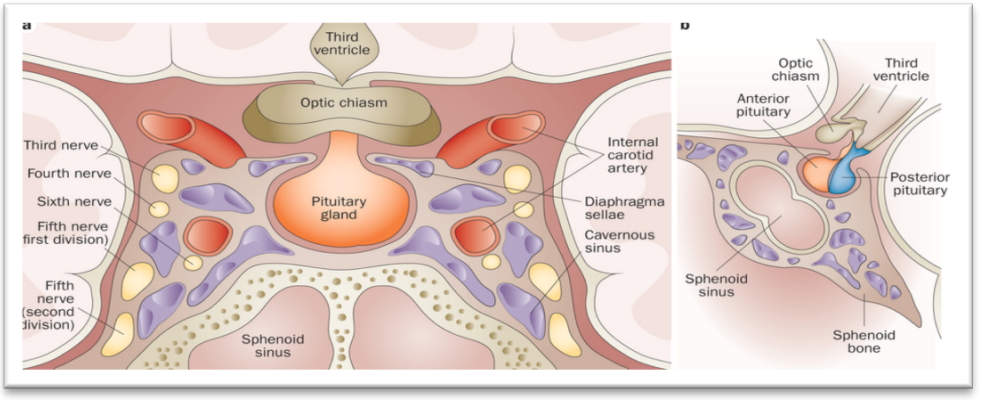
Pituitary Development :

- Posterior pituitary (neurohypophysis) :
  - ✓ from neural cells as an outpouching from the floor of 3rd ventricle .
  - ✓ Pituitary stalk joins the pituitary gland with hypothalamus

- Anterior pituitary (adenohypophysis) :
  - ✓ From Rathke's pouch, Ectodermal evagination of oropharynx
  - ✓ Migrate to join neurohypophysis



- **Pituitary Anatomy :** (important for the symptoms caused by the tumer pressure)
  - ✓ Lies at the base of the skull as **sella turcica**
  - ✓ **Roof** is formed by diaphragma sellae(a reflection of dura matter preventing CSF from entering the sella turcica)
  - ✓ **Floor** by the roof of sphenoid air sinus
  - ✓ **Lateral** wall by cavernous sinus (containing III, IV, VI, V1, V2 cranial nerves)
  - ✓ Pituitary stalk and its blood vessels pass through the diaphragm
  - ✓ Optic chiasm lies 10 mm **above** the gland and anterior to the stalk



FUNCTION OF PITUITARY GLAND

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Anterior lobe :

- Growth Hormone (GH)
- prolactin (PRL)
- Thyroid Stimulating Hormone (TSH)
- Luteinizing hormone (LH) and Follicle Stimulating Hormone (FSH).
- adrenocorticotrophic hormone (ACTH)

Cell	Corticotroph	Gonadotroph	Thyrotroph	Lactotroph	Somatotroph
Hormone	ACTH	FSH, LH	TSH	Prolactin	GH
Stimulators	CRH, AVP, gp-130 cytokines	GnRH, Estrogen	TRH	Estrogen, TRH	GHRH, GHS
Inhibitors	Glucocorticoids	Sex steroids, inhibin	T3, T4, Dopamine, Somatostatin, GH	Dopamine D2 receptor	Somatostatin, IGF-1, Activins
Target Gland	Adrenals	Ovary, Testes	Thyroid	Breast and other tissues	Liver, bone and other tissues
Trophic Effects	Steroid production =cortisol	Sex steroid, Follicular growth, Germ cell maturation	T4 synthesis and secretion	Milk Production	IGF-1 production, Growth induction, Insulin antagonism

Posterior lobe :

- Oxytocin
- VASOPRESSION (ADH) = ↑secretion → SIADH , ↓secretion → **Diabetes insipidus**

DISORDERS OF PITUITARY FUNCTION

Hypopituitarism *

- Central hypoadrenalism
- hypogonadism
- Hypothyroidism
- GH deficiency
- Panhypopituitarism → means more than 3 hormone

* Hypopituitarism resulting from pituitary adenomas (most common cause) is due to impaired blood flow to the normal tissue, compression of normal tissue, or interference with the delivery of hypothalamic hormones via the hypothalamus-hypophysial portal system.

Hyper secretion of Pituitary Hormones

- **Hyperprolactinemia** → PRL secreting cell disorder = prolactinoma
- **Acromegaly** → Growth Hormone (GH) secretiong cell disorder = Somatotropinoma
- **Cushing's Disease** → adenocorticotrophic hormone → ACTH secreting cell disorders= Corticotropinoma

Etiology of Pituitary Masses:

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1 : Adenoma

- ✓ Functioning → hormone secreting adenoma → Prolactinoma , Somatotropinoma Corticotropinoma ,Thyrotropinoma,Other mixed endocrine active adenomas
- ✓ Non-Functioning Pituitary Adenomas → no secretion

Here if the mass is micro there will be no symptoms

If it macro it will cause mass symptoms = headache , visual disturbances and nausea and maybe Hypopituitarism → due to compression of normal tissue

2 :Malignant pituitary tumors: Functional and non-functional pituitary carcinoma

3 : Metastases in the pituitary (breast, lung, stomach, kidney)

4 : Pituitary cysts: Rathke's cleft cyst, Mucocoeles, Others

5 : Empty sella syndrome

6 : Pituitary abscess

7 : Lymphocytic hypophysitis

8 : Carotid aneursym

Non- functional pituitary adenoma:

- Absence of signs and symptoms of hormonal **hypersecretion**
- 25 % of pituitary tumor
- Needs evaluation either micro or macroadenoma → (micro = less than 1cm , macro =more than 1 cm)
- Average age 50 – 55 yrs old, more in male

- **Presentation of NFPA**:
  - As incidentaloma by imaging
  - Symptoms of mass effects (mechanical pressure)

    Mass effect tumour expansion lateral compressing cavernous sinus causing cranial nerve palsy like double vision, stretching meninges causing headache, or pushing temporal lobe causing seizure, pushing optic chiasm causes **bitemporal hemianopia** or headache from apoplexy
  - Hypopituitarism (mechanism)

    is due to impaired blood flow to the normal tissue, compression of normal tissue, or interference with the delivery of hypothalamic hormones via the hypothalamus-hypophysial portal system
  - **Gonadal hypersecretion** (in histopathology staining + ve for LH/FSH)

- **Treatment:**

- ❑ Surgery if indicated
- ❑ Observation , in Slow growing tumour
- ❑ Adjunctive therapy: - Radiation therapy
  - Dopamine agonist → decrease prolactin +tumor shrinking
  - Somatostatin analogue

Table 2
Clinical characteristics of NFPA patients.

	Nomikos et al[15]	Losa et al[16]	Chang et al[17]	Ferrante et al[51]	Total
Number of patients	721	491	663	295	2170
Mean age	54.2 ± 19	–	53 (median)	50.4 ± 14.1	
Gender (M/F)	401/320	276/215	394/269	161/134	1232/938 (56.7% M)
Incidental finding	57 (7.9%)	57 (11.6%)	49 (7.4%)	–	163/1875 (8.7%)
Headaches	70 (9.7%)	–	212 (32%)	122 (41.4%)	404/1679 (24%)
Visual deficits	222 (30.8%)	287/486 (59.1%)	327 (49%)	200 (67.8%)	1036/2170 (47.7%)
Pressure on cranial nerves	–	22 (4.5%)	26 (3.9%)	–	48/1154 (4.2%)
Apoplexy	27 (3.7%)	48 (9.8%)	24 (3.6%)	–	99/1875 (5.3%)
Symptoms of Hypopituitarism Documented	345 (47.8%)	–	342 (51.6%)	118 (40%)	805/1679 (48%)
Hypopituitarism	614 (85%)		–	183 (62%)	797/1016 (78.4%)
Hypogonadism	512/659 (77.7%)	335/474 (70.7%)		128 (43.3%)	975/1261 (77.3%)
Hypoadrenalism	230 (31.9%)	115/478 (24.1%)		77 (26.2%)	422/1494 (28.2%)
Hypothyroidism	129/658 (19.6%)	116/462 (25.1%)		72 (24.5%)	317/1415 (22.4%)
Hyperprolactinemia	199 (27.6%)	251/462 (54.3%)	–	82 (27.6%)	532/1478 (35.9%)

Normally, dopamine, produced in the hypothalamus, inhibits prolactin secretion by the anterior pituitary. Compressing the pituitary stalk decreases the inhibitory effect of dopamine and increases prolactin levels.

Functional Pituitary Adenoma

1)Prolactin

Function: stimulates breast development and milk production

Hyperprolactinemia :

Causes:

In females, pregnancy must always be ruled out first

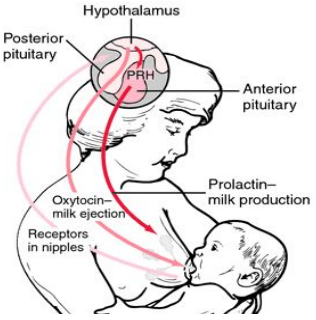
- **prolactinoma**
- **Hypothalamic Dopamine Deficiency** → Diseases of the hypothalamus(including tumors,arterio-venous malformations, and inflammatory processes
- **Defective Transport Mechanisms** → **Section of the pituitary stalk or stalk tumors**
- **Lactotroph Insensitivity to Dopamine**

  Dopamine-receptor-blocking agents: phenothiazines (e.g. chlorpromazine), butyrophenones (haloperidol), and benzamides (metoclopramide, sulpiride, and domperidone)

- **Stimulation of Lactotrophs** → Hypothyroidism- increased TRH production (acts as a PRF)
  Estrogens: stimulate lactotrophs (here normally TRH is stimulatory for Prolactin secretion , so in case of Hypothyroidism it will cause ↑ level of TRH as compensatory mechanism → ↑ prolactin and Thyroid hormone).

  injury to the chest wall abnormal stimulation of the reflex associated with the rise in prolactin that is seen normally in lactating women during suckling

So Not all hyperprolactinemia is due to a prolactinoma …



❖ Prolactinomas :

1:Most common type of functional pituitary adenomas

2:Of women with prolactinomas- 90% present with microprolactinomas

3:Of men with prolactinomas- up to 60% present with macroprolactinomas

❖ Clinical Features of Hyperprolactinemia / Prolactinoma :

women	Men
Secondary **amenorrhea** + infertility → prolactin inhibit GnRH → decrease FSH&LH **Glactorrhea**	Loss of libido → prolactin inhibit GnRH → decrease testosterone Headache → they present with macroprolactinomas Gynecomastia

CONT. Functional Pituitary Adenoma

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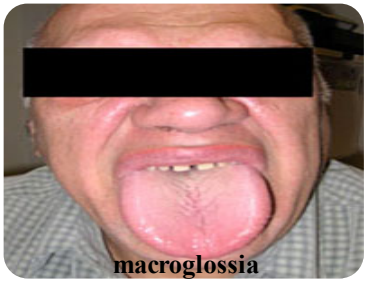
- **Management**
  - **1:Medical Medical Medical Medical therapy (the Dopamine agonist)**
  - **2:Surgical resection**
  - **3:Radiation therapy**

2)Growth hormone :

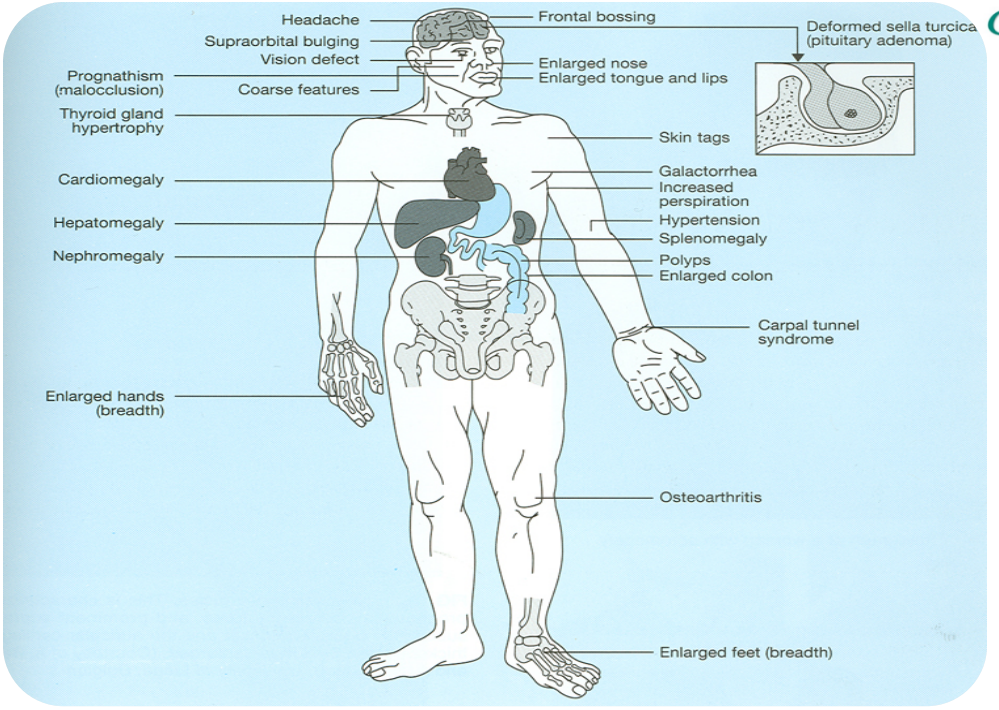
Function : Stimulation of growth of bones (linear and lateral) , cartilage & connective tissue; mediated mainly via Somatomedin C (IGF-1)

Type of disorder	Pituitary tumor as mass effect →GH deficiency (Short stature)	Hyper functioning mass	
Clinical presentation	Children →growth delay Adult →hypoglycemia	Children : **gigantism** due to increase linear bone growth (epiphyses have not fused)	Adult: **acromegaly** no linear growth because epiphyses are fused only increase lateral bone growth (hand , feet jaw)
Diagnosis	1 : ↓GH, IGF-I level 2 : Dynamic testing: clonidine stimulation test, glucagon stimulation, exercise testing, arginine-GHRH, insulin tolerance testing 3 : x-ray	IGF-I ↑the best screening test GH level (not-reliable, pulsatile) Fasting and random blood sugar, HbA1c → they develop DM → the gluconeogensis action of GH Lipid profile ↑ Cardiac disease is a major cause of morbidity and mortality → IGF-1 causes enlargement of organs such as the heart HTN in 40% LVH in 50%	
Management	GH replacement	**Surgical Surgical Surgical resection of the tumor** Medical thereby → Somatostatin analogue	


macroglossia

CONT

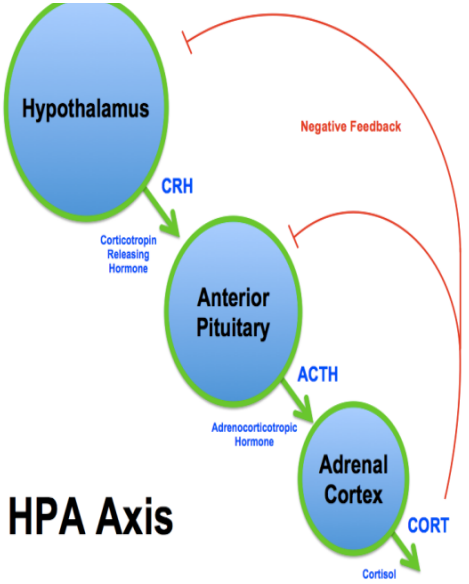
- ## ACROMEGALY CLINICAL FEATURE

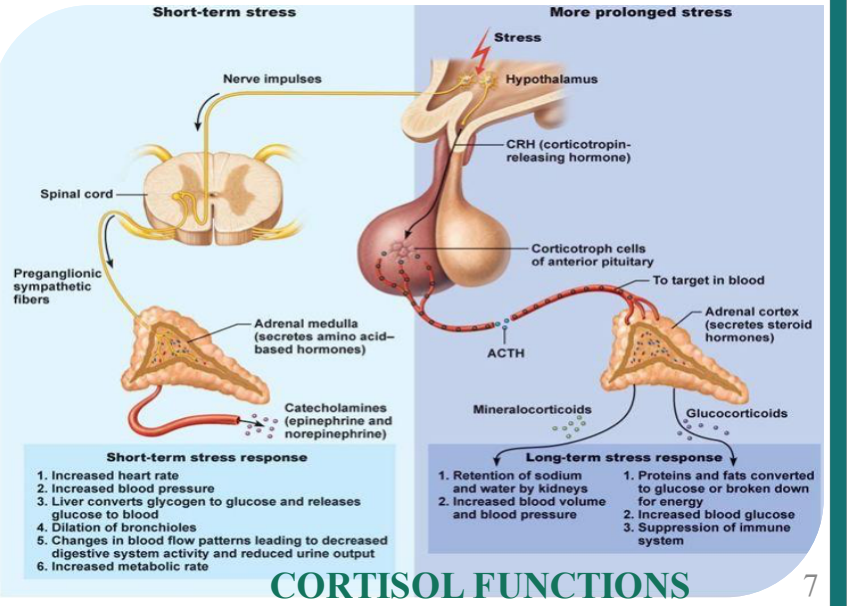


3) ACTH:

Function : regulate the steroid hormone cortisol. Cortisol is released by the adrenal gland.

HPA-axis hypothalamic–pituitary–adrenal axis





CORTISOL FUNCTIONS

Cortisol functions :

1. Increase blood pressure
2. Bone formation inhibition
3. Immune system suppression
4. Anti inflammatory
5. Gluconeogenesis , lipolysis ,proteolysis

Adrenal insufficiency can be:

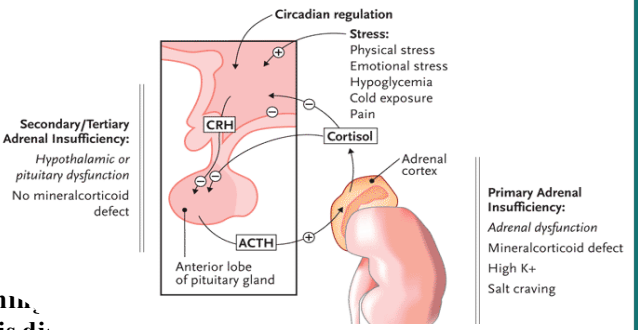
Primary
caused by diseases of the adrenal gland

Secondary
Caused by interference with corticotropin (ACTH) secretion by the pituitary gland

Tertiary
Caused by interference with corticotropin-releasing hormone (CRH) secretion by the hypothalamus

Clinical presentation:

- **Nausea ,Vomiting, Abdominal pain and Diarrhea**
- **Tiredness**
- **Weight loss**
- **Hypotension**



Diagnosis:

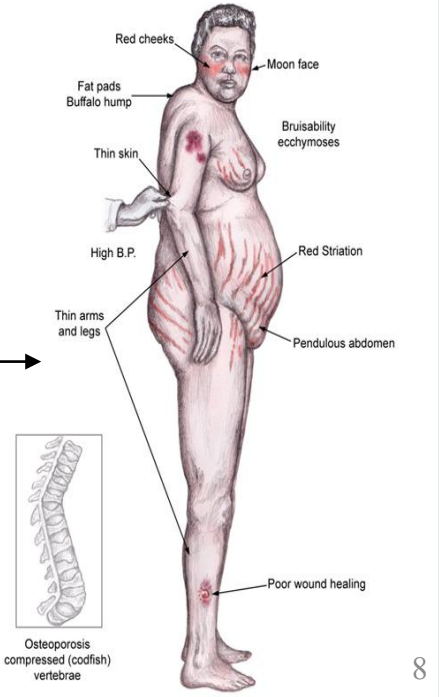
measurement of serum cortisol and ACTH in the morni
If the serum cortisol is low, then cortisol insufficiency is di

Management:

Cortisol replacement

ACTH-Adenoma :

ACTH-Adenoma may be clinically silent or may cause hyper cortisolism , manifested clinically as ***Cushing syndrome***, because of the stimulatory effect of ACTH on the adrenal cortex



- **excessive cortisol (*Cushing syndrome)***
  - 80 % HTN & LVH
  - Glucose intolerance in 60%, control of hyperglycemia
  - Osteoporosis with vertebral fracture→→
  - positioning of patient in OR (50 %), 20 % with fracture
  - thin skin→→ difficult IV cannulation, poor wound healing

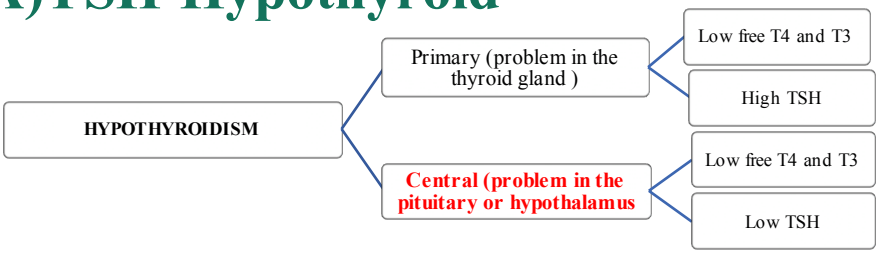
- **Cushing's-Management**
  - Surgical resection of pituitary
  - Medical Treatment

4)TSH

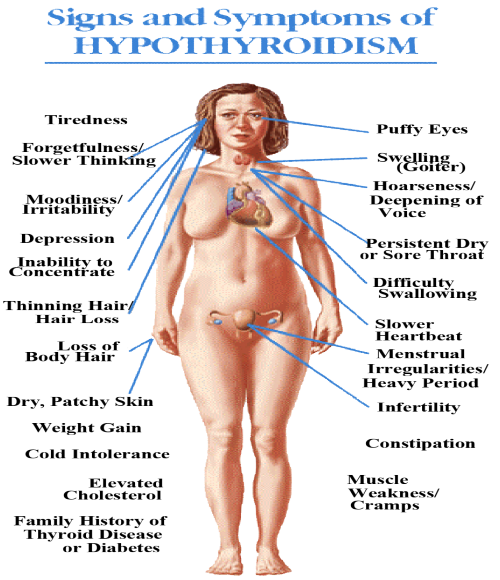
FUNCTION:

It tells the thyroid gland to make and release thyroid hormones

A)TSH-Hypothyroid



1-Central Hypothyroidism :



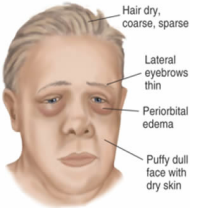
Clinical presentation:

↓metabolic processes

- Fatigue
- slow movement and slow speech
- cold intolerance
- Constipation
- weight gain
- Bradycardia

accumulation of matrix glycosaminoglycans in the interstitial spaces of many tissues

- puffy face
- coarse hair and skin
- enlargement of the tongue



Treatment :

- Thyroxin replacement
- Surgical removal of pituitary adenoma if large

B)TSH-Producing adenoma :

Very rare < 2.8 %

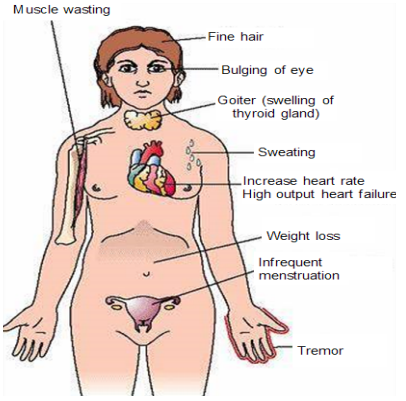
Signs of hyperthyroidism

High TSH, FT4, FT3 → (free T3 and free T4)

Treatment prop with anti-thyroid medications

Surgical resection of adenoma

Medical therapy: Somatisation Analogue



5)LH &FSH

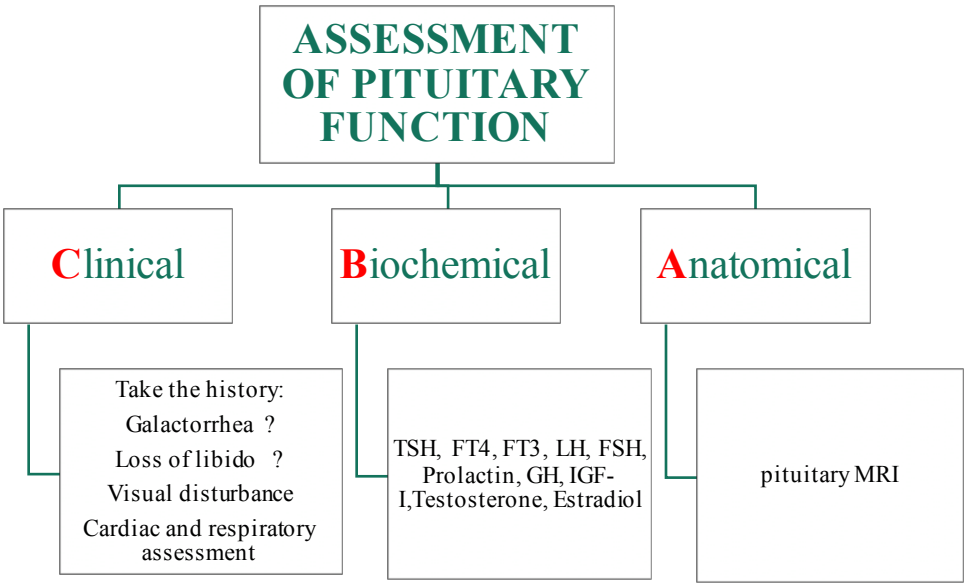
Gonadotroph Adenoma Very rare

Laboratory finding :

- High FSH and Low LH
- High serum free alpha subunit
- High estradiol , thickened endometrium and polycystic ovaries

Treatment :

- Surgical resection if large
- Radiation therapy



MCQs

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1- What happens where there is excess in vasopressin?

A. Diabetes insipidus
B. Diabetes mellitus
C.SIADH
D. Dehydration

2. Endocrinopathies are classified as primary, secondary, or tertiary
.Which organ is dysfunctional if the endocrine disorder is a secondary disease?
A. Adrenal cortex
B. Pancreas
C. Hypothalamus
D. Pituitary gland

3-Which approach does the surgeon take for a pituitary gland surgery?
A. Trans-nasal
B. Trans-cortex
C. Trans-rectal
D. Trans-sphenoidal

4-Hyposecretion of Growth hormone. Which type of condition corresponds to these findings?-Low GH-Low IFG-1-Responds to GH stimulation
A.GH- deficient dwarfs
B. Pygmies
C. Laron type dwarfs

5-Which condition is seen when there is hyper secretion of growth hormone in children?
A. Gigantism
B. Acromegaly

6-In enlargement of a pituitary gland anterior superiorly, the optic nerves will be compressed (temporal half - side view). The patient will not be able to see the sides. What condition is this called?
A. Temporal hemianopia
B. Semi temporal hemianopia
C. Bitemporal hemianopia
D. Bitemporal myopia

1-C
2-D
3-D
4-A
5-A
6-C

SAQs

Q1: The Posterior pituitary arises embryologically as an:
from neural cells as an out pouching from the floor of 3rd ventricle .

Q2: Given these laboratory data: TRH level: normal ,TSH level: normal ,T3 & T4 level: Low, Is this hypothyroidism due to primary, secondary or tertiary cause?
Primary hypothyroidism

Q3: What is the treatment for prolactinoma?
Dopamine agonist

Q4: In hypothyroidism, the cause can be evaluated by simply giving a TRH injection. If TRH is given, and after that TSH serum level is discovered to be normal, where is the defect that is causing the disease?
Hypothalamus → IF given TRH injection, TSH normal: Hypothalamic defect. If TSH remain low: Pituitary defect

Thanks for checking our work

G00D LUCK

DONE BY :

Abdulrahman almizel Amal aseeri

For any suggestions or questions please don't hesitate to contact us on:
medicineteam34@gmail.com