PITUITARY GLAND

Anatomy :

- It is a small gland ẅ wt. about ½ gm in normal adults
- Occupies the sella turcica.
- And separated from the intracranial fossa by the diaphragma sellae ẅ is pierced by i pit. Stalk

Relations :

1. Superiorly : → optic chiasma and supra-optic hypothalamic nuclei .
2. Laterally : → - cavernous sinus.
   - internal carotid arteries
   - uncinate gyrus of I temporal lobe
3. Posteriorly : → Inter-peduncular fossa

Divisions and Histology :

Developmentally and physiologically the pit. is Subdivided into :

2 parts :

1. Adenohypophysis = Ant. lobe of i pituitary

It comprises → Pars distalis
It comprises → Pars tuberalis
It comprises → Pars intermedia

It contains 3 types of cells ẅ has been termed according to their staining character :

They are → Chromo phobe cells 50%
They are → Acidophill cells 35% ----- GH
They are → Basophill cells 15% ---- TSH and Ganado T.H

2. Neurohypophysis = Post lobe of i pituitary .
   It comprises → infundibulum and infundibular stalk .
   It contains specialized secretory never cells known as pitucytes.

Physiology :

(1) Adenohypophysis

This secretes certain trophic hormones ẅ stimulate other Endocrine glands , thus acting as the maistro of the endocrine orchestra .

The main trophic hormones are :

(I) Somatotrophic hormone (Growth hormone = G.H.) :

- This stimulate growth of the skin, muscles, viscera and bone .
- It also has a diabetogenic effect by antagonizing the hexokinase enzyme .
- It may have a parathyrotrophic action .

(II)Thyrotrophic hormone (Thyroid Stimulating hormone = TSH)

It has 2 actions on the thyroid :

(A) Growth action : stimulating i growth & vascularity of i thyroid.

(B) Metabolic action : increasing the picking up of the iodide by the thyroid and stimulate the formation of T4,T3.

(III) Adenocorticotrophic hormone (= ACTH) :

- This stimulates the zona fasciculata and zona reticularis of the suprarenal cortex → stimulate the formation of glucorticoids adrenal sex hormones.
- It has minimal effect on the secretion of aldosterone by the zona glomerulosa.

(IV) Ganadotrophic hormones :

(A) Follicular stimulating hormone (= F.S.H) = Serum G.T stimulate the growth & maturity of i graffian follicle in ♀ maturity of the spermatozoa in ♂ .

(B) Luteinising hormone (= L.H) = Chorionic G.T stimulate the maturity maintenance of corpus luteum in ♀ & interstitial cells of i testicles in ♂

(C) Luteotrophic hormone (L.T.H) = Prolactine stimulate the development of the duct system of the breast & its preparation for milk production .

(V) Melanocyte stimulating hormone (M.S.H) :

Secreted by i pars intermedia → stimulate the pigment of i skin .

(VI) Exophthalmos producing substance (E.P.S)

→ Malignant exophthalmos .

• Relation of adnohypophysis to other endocrine gland :-

There are feedback mechanisms between the pituitary and target endocrine gland; i.e; when i hormone secreted by one of i target endocrine

glands decreased in the blood , the pit. Increases the corresponding trophic hormone and vice versa .

- **Relation ( ) the hypothalamus & BL. Supply of i pit. :**

- Arterial BL. Supply :- Superior and inferior hypophyseal a .
- Venous drainage :- There is a portal type of i venous drainage of the pit .

The afferent hypophyseal veins originate from the region of The hypothalamus & infondibular stalk and pass to pit. where they break down into smaller banches then to a capillary network from ẅ new veins arise and collect to from i efferent hypophyseal veins → into i dural venous sinuses (cavernous and inter-cavernous sinuses).

By this distribution of venous drainage the relation between the physiology of the hypothalamus & pit. could be explained :

The hypothalamus secretes certain releasing hormones → circulate in the hypophyseal portal veins to the pit. → stimulate the release of the corresponding trophic hormone → pass through the efferent hypophyseal veins to the general circulation → act on i target endocrine glands .

(2) Neurohypophysis

2 Hormones :

(I) Vasopressin (Pitressin or ADH) :

Regulation of reabsorbption of H2O by the distal convoluted and collecting tubule of nephrons → ↑ permeability of cells to H2O → so, H2O can pass freely from the hypotonic tubular fluid to the hypertonic interstitial tissue of the kidney .

If i hormone is ↓ → H2O can't diffuse → excess and hypotonic urine .

(II) Oxytocin (= pitocin) :

Action :

1. Stimulate the contraction of the gravid uterus.
2. Stimulate the ejaculation of milk from fully mature Breast.
3. Mild anti-diuretic effect.
4. +++++ vascular spasm.

Diseases of the Pit. Gland

- **Hyper-Function of adenohypophysis :**

Possible C/P :

1. Acromegally.
2. Giagantism.
3. Cushing syndrome (pit. cushing)
4. Thyroid acropathy.

5. Hyper-pigmentation of skin.
6. Malignant exophthalmos.

Acromegally

AE : Results from ↑ function of " acidophil cell " of adenohypophysis occurring after closure of epiphysis of long bones; i,e; above 20 years .

Due to :

1. Simple hyperplasia of the acidophilic cells .
2. acidophilic adenoma ẅ is usually a small tumor rarely grows rapidly → erodes the sella turcica.
3. acidopil adeno-carcinoma (very rare) .

Physiologic disturbances :

The ↑ functioning acidophil cells → ↑ Growth hormone → stimulate growth of skin,ms, viscera and bones (ẅ can't grow from epiphysis e.g.; skull, mandible and ribs). Bones can not grow in length because of closure of their epiphysis but they grow in breadth as a result of new sub periosteal bone formation .

In late stages the pit. gland becomes exhosted → Hypofunction

C/P :

- Onset : Gradual
- Course:- In the majority of cases the disease runs slowly Progressive course, in few pts the disease runs a so rapid course that is → malignant acromegally

(A)Endocrinal chics :

1. Facies :
   - Big skull.
   - Big skull prominences and bones .
   - Prominent Supra-orbital ridges .
   - Wrinkled fare head .
   - Big nose . Ear pinna , lips .
   - Big wrinkled tongue .
   - Prognathic low jaw é wide apart teeth .
2. Hands :
   - Spade like hands .
   - Big hands with thick and broad fingers é Terminal broad phalanges .
3. Skin :
   - Overgrown , wrinkled especially in Forehead → folds .
   - Hair → long. Thick .
   - Cutaneous hyper-pigmintation → common .
4. Muscular :

- Early : True hypertrophy of ms & ↑ strength .
- Late : (when ↓ pit.) → muscular weakness and hypotonia.

5. Skeletal :
   - Skull : Big with thick ridge & prominent bones
   - Mandible : Prognathic
   - Long bones : Broad and thick.
   - Thoracic cage : ↑ed with broad ribs .
   - Multiple exostoes .
   - Hypertrophic osteo-arthropathy .
6. Visceral :
   - Cardiomegally, hepatomegally and splenomegally may not be detected clinically due to ↑ed body size .
7. Gonadal :
   - Early : ↑ Lipido and potency
   - Late : Pit. exhaustion
     ♂ → ↓ Lipido and potency
     ♀ → Amenorrhea
     Both Show fall of axillary & pubic hair .
8. Possible associations :
   - ↑ B.P - D.I - D.M
   - polyneuropathy : due to hyperplasia of the C.T. of nerves pressing on nerve bundles .
   - spontaneous lactation in ♀.
   - Goiter.

(B)Non Endocrinal :

If acromegally is due to a Pit. tumor : certain pressure, nervous clinical picture :

(1) Bitemporal headache :
   - Due to expansion of the sella . The headache is relieved when the tumor gets out of sella to reappear when intra-cranial pressure increases .

(2) Bitemporal hemianopia :
   - Due to pressure on optic chiasma .

(3) Cavernous sinus syndrome :
   - Due to pressure on the cavernous sinus :
     - Exophthalmos .
     - Chemosis of conjunctiva .
     - Ophthalmoplagia .
     - Oedema of eyelids .
     - Papillidema .

- Loss of corneal reflex .

(4) Pressure on uncinate gyri → uncinate fits

(5) Pressure on hypothalamic nuclei →hypothalamic syndrome = polyphagia + polyurea + somnolence

(6) Pressure on cerebral peduncles → pyramidal tract lesion .

Investigation :

(1) X- ray of skull :

- Big skull .
- Thick skull bones .
- Enlarged frontal air sinuses .
- Ballooning of sella turcica in cases of tumors .

(2) X- ray of hand :

- Thick phalangeal bones with tufting of their terminal end (Mushroom-like expansion).

(3) B.M.R Early ↑ late ↓

(4) RBCs Early ↑ late ↓

(5) 17-ketosteroids in urine Early ↑ late ↓

(6) serum Ph $^{+++}$ Early ↑ late ↓

Treatment :

a. Medical :

- Bromocriptine, somatostatin
- Parlodal, Dopagen 2-5 m.g. (1/2 X 2 then gradually ↑ up to 4 tabs/day)

b. Irradiation : 200 R/ SIT / days for 5 days.

- indication :
  - Failure of medical treatment.
  - No field defects
  - Unfit for surgery

c. Surgery : hypophesectomy in the tumor é start of vision changes .

Gigantism

❖ AE :

Hyperactivity of acidophil cells of adenohypophysis occurring before closure of epiphysis of long bones .

Due to :

1. Simple hyperplasia of acidophil cells

2. Acidophil adenoma
3. Acidophil Adenocarcinoma

❖ Pathogenesis :

Excess growth hormone → over growth of all body tissue including long bones.

❖ C/P :

Onset : Gradual

Course : rapidly progressive , most pts die before age of 20 years .

Features (chics)

a. Gigantism :

Proportionate , The Span is equal to the height .

Head ↔ Pelvis = Pelvis ↔ Feet.

b. Hands :

Big with long tapering fingers .

c. Other C/P of acromegally .

D.D. :

1. Familial gigantism :
   - ❖ Body measurements one less
   - ❖ No other changes
   - ❖ +ve family history .
2. Hypogonadal Gigantism :
   - ❖ Sex hormone help closure of epiphysis , so if they are deficient → closure delayed → Gigantism

   (A) Body measurement , disproportionate , very long limbs

   The span > height

   Head ↔ pelvis < pelvis ↔ feat

   (B) Other C/P of ↓ gonadism :
   - ↓ Lipido .
   - Impotonce .
   - loss of temporal recession .
   - Pallor .
   - Gynaecomastia .
   - General asthenia .
   - Loss of hair in upper lip & chin .

Treatment :

1- Irradiation.

2- Hypophysectomy.

3- Androgens.

Hypofunction of Pit. Gland

→ Hypofunction of adenohypophysis

(1) Levi - lorrain syndrome (Genetic developmental defect).

(2) Simmond's disease (Acquired).

(3) Selective hypo-pitutarism :

(A) Pit. myxoedema → Sheehan's syndrome

(B) Pit. hypocorticolism

→ Hypofunction of Neurehypophysis : → D.I

Levi – Lorrain Syndrome

- **AE** :

Congenital pan-hypo-pit. Due to genetic defect in the development of the pit. gland .

- **C/P** : chics :
  - Facies : small facial features with small eye slits nose , ear pinna , lips and tongue.
  - Hands : small with thin tapering fingers .
  - Infantilism :

(I) Dwarfism →proportionate.

(II) Hypogonadism → appear only at puberty :

- Small testis ± cryptochisism .
- Small penis .
- No scrotal pigment .
- If ♀→ 1ry amenorrhea .

  - Skin : Thin , silky .
  - Microsplanchiae .
  - Voice children tone .
  - High mentality and the child is active .

D.D. : of Infantilism [(1) Endocrinal, (2) Hypothalamic, (3) Genetic, (4) Systemic diseases]

(I) *Endocrinal*:

(A) Juvenile D.M. :

C/P & inv : chic

Very liable to diabetognic icotosis .

(B) Cretinism :

1. Disproportionate
2. Facial :
   - Apathetic
   - Puffy eyelids
   - big protruded tongue
   - Depressed nasal bridge
   - Big thick lips
3. Hand : stumpy with dorsal pads and short fingers
4. Skin : Thick coarse , rough ♀ Alopecia is common
5. Mentality ↓

(II) *Hypothalamic causes* :

■ Froehlich's Syndrome :

AE : Hypothalamic lesions :

(1) Encephalitis
(2) Craniopharyngioma or meningioma
(3) Idiopathic

C/P :

(1) Dwarfism
(2) Hypogonadism
(3) Obesity ♀ type
(4) Skin : thin , silky
(5) Hands : small with tapering fingers
(6) Mentality well but childish psychosis
(7) Hypothalamic symptoms
Polyuria, polyphagia & somndence

(III) *Genetic causes* :

(1) Turner's syndrome :

- Dwarfism
- Hypogonadism with 1ry amenorrhea
- Atrophy of the breast
- Webbing of the neck
- Cubitous vulgus
- Coarctation of aorta
- ♀ with 45 chromosome (44 + XO)

(2) Laurence Moon - Biedle Syndrome :

- Dwarfism
- Hypogonadism
- Polydactyly
- Retinitis pigmentosa
- Obesity
- 47 chromosomes (44+ xxy)

Trisomy = one of the auto-chromosomes is 3 instead of 2 .

(3) Down Syndrome (Mongol) :

- 47 Chromosome (usually Trisomy 21)
- dowarfism
- hypogonadism
- bradycephaly
- upwards slanting of the eyes
- Deep crease across the palm
- liable to → Cooley's anemia

(IV) *Systemic diseases* :

(1) Malnutrition .

(2) C.V.S : * Congenital cyanotic heart diseases .
* Heart failure in young children .

(3) Chest : Cong. Cystic lungs .

(4) G.I.T : L.C.F. in early age, steatorrhea, parasites .

(5) Renal : * Cong polycystic icidney .
* Cong tubular defeats .
* Chronic renal – failure in children .

Treatment Of Levi – Lorrain Infantilism :

(1) Pituitary hormones guarded prognosis

(2) Chorionic Gonadotrophins (C.G.T) in cryptorchidism for 6 weeks → If failed → surgery .

(3) Androgens : Best Stimulus for growth
-ve overdose → premature closure of epiphysis .

Simmond's disease

AE :

(1) Autoimmune → atrophy
(2) Traumatic as fracture base
(3) Inflammation : basal meningitis, encephalitis
(4) Granulomtus : T.B., Sarcoidosis
(5) Neoplasm; As :

- B. chromophobe adenoma
- M. supra-sellar meningioma
- Chiasmal neuroma
- Craniopharyngioma

Pathogonesis : [Panhypopitutarism]

C/P :

1. Due to ↓ G.H
   - Simmond's Cachexia
   - Muscular weakness, flabbiness
2. ↓ Gonadotrophic hormones :
   - Both ♀ ♂
     ↓ lipido and loss of pubic & maxillary hair
   - ♂ → loss of beard and moustache, impotence & Testicular atrophy .
   - ♀ → breast atrophy
3. ↓ TSH → Thyroid myxedema but the skin is not so thick
4. ↓ A.C.T.H. :
   - ↓ BL. Glucose level
   - ↓ Bl . Pressure .
5. ↓ M.S.H → Pallor and generalized depigmentation

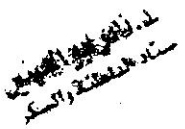
N.B.: Pallor in Summand's : due to :

1. Generalized depigmentation
2. Anemia .
3. Myxedema

Investigation :

1. X-ray skull : exclude brain tumors.
2. BMR .
3. 17-ketosteroids in urine .

4. F.B.S.



Treatment :

1. Treatment of the cause
2. Replacement thyroid extract
3. cortisone 1-2 eq/d

Selective Hypopitutarism

(A) Pit. Myxoedema = Sheehan's syndrome

- AE :

  Mostly post partum Hge .

- C/P : myxoedema But
  1. Pubic and axillary hair absent
  2. Skin not too thick
  3. Cholesterol not high
  4. BMR & RAI uptake ↓ but They improve by T.S.H.

(B) Pit . Hypocorticolism :

- C/P : Addison But
  1. Skin not pigmented
  2. Pubic and axillary hair absent
  3. Esinophils ↑ but ↓ by ACTH .
  4. 17 ketosteroids in urine ↓ but ↑ by ACTH
- Treatment :

  Replacement therapy (thyroid & cortisone)

D.I. (↓ A.D.H)

AE :

1. Idiopathic in young
2. Traumatic
3. Inflam. :
   - Basal meningitis
   - Encephalitis
4. Granulomatus :
   - T.B , $ Sarcoidosis
   - Xanthomatosis
   - Hand Schaller Christian Syndrome
5. Tumors : (Bengin & Malignant)

- Chromophobe adenoma
- Craniopharyngioma
- Meningioma (supra-sellar)
- Chiasmal neuroma

Pathogenesis :

Cells of distal convoluted tubules (DCT) and collecting tubules → impermeable to H2O.

C/P :

- Polyurea 5-30L/d
- Thirst +++
- Polydepsia → G.I.T troubles .
- Psychosis & insomnia .
- Dehyderation .

Investigation :

1. Urine :
   * Volume : 5-30 L/d * Aspect : clear
   * S.G : 1000-1004 * Colour : H_2O colour
2. X-ray skull to exclude trauma or tumor .
3. hypertonic saline test :

   H_2O deprivation, 24 hours

   In 45 minutes

I.V. Saline

0.25 cc/k.g. B.W / minute in 45 min.

- In normal person → ↑ BL . osmolarity

→ Stimulation of osmo-receptors of hypothalamus

→ ↑ Pitressin releasing hormone → Pitressin → Oliguria

- In D.I → No response

D.D. :

D.D. of Polyurea : physiological, pathological and K loosing Diuretics

1- Physiological :

- winter.
- ↑ H2O.
- ↑ tea, coffee, beer & cola.
- psychogenic polydepsia.

2- Pathological :

A- Renal causes :

- Ch. R.F.
- Diuretic stage of A.R.F.

- Nephrogenic D.I.
- Congenital tubular defect in reabsorption of H_2O " one cause of Nephrogenic D.I. "
- Intermittent Hydronephrosis.

B- <u>Endocrinal causes</u> :

- D.M.
- D.I.
- ↑ Pit.
- ↑ Thyroid.
- ↑ Parathyroid.
- ↑ Corticosteroids [conn's synd. , cushing synd. , pheochromocytoma]

D.I	NDI	Psy. Polydepsid
1. Hypertonic saline	-ve	+ve
2. Ptressine test +ve	-ve	+ve
3. Associations	Other tubular defect	Psychosis

<u>Treatment of D.I.</u> :

1. ttt of The cause.
2. Replacement therapy :
   - Pitressin tannate : 5u I.M./48 hs (or spary or drops).
   - Dessicated pituitary : 50 mg snuff/d.

THYROID GLAND

- ***Physiology*** :
  - The Thyroid gland forms T3 &T4 under influence of TSH of the anterior Pituitary.
  - This TSH → ↑ Size & Vascularity of the gland + ↑ uptake of iodides → ↑rate of synthesis of T4 & T3
- Steps of ***formation*** of Thyroid hormones :
  1. Thyroid Picks up inorganic iodides from the Plasma
  2. Inorganic iodides → active iodine
  3. 2 molecules of this active iodine + Tyrosine→ DIT
  4. 2 (DIT) → T4
  5. (Thyroxin + globulin) stored inside the thyroid acini as thyroglobulin when needed , this thyroglobulin break → T4
  6. This T4 :
     - blood

- some [T4 (- i) → T3 → Blood]

Diseases of the Thyroid Gland

I) Pathological Classification :

1. Enlarged ducts hypertrophy or ↑ normal tissues :-
   - Non toxic : (simple - nodular)
   - toxic .
   - hypothyroid goiter.
2. ↑ due to infiltration by abnormal tissues:-
   - thyroiditis (acute , chronic)
   - tumors (B,M)

II) Functional Classification :

- Hyperthyroidism
- Hypothyroidism

Hyperthyroidism

Types :

1. Primary : occurs on top of a previously normal thyroid.
2. Secondary : on top of nodular goiter or less occasionally thyroid adenoma

1ry Hyperthyroidism
= 1ry thyrotoxicosis = Grave's dis.

AE :

❖ Predisposing factors :

1. Age : commonest 20- 40 years.
2. Sex : ♀ > ♂.
3. Emotional & psychic disturbances are important predisposing factors .
   - The disease is more common in irritable people who are under continuous emotional stress.
   - Occasionally thyrotoxicosis is ppt by sudden major psychic troubles
4. Infections : some cases may occur after streptococcal infection. Rh. fever, enterica or other infections .

Pathogenesis : Theories :

1) ↑ Production of TSH : it is supposed that prolonged emotional stress → stimulate the hypothalamus →↑ thyrotrophin releasing hormone ẅ circulate in the Pit. portal system of veins to the adenohypophysis → stimulate the Pit. cells → ↑ secretion of thyrotrophic hormone →↑ size of thyroid gland → T4, T3 .
2) ↑ sensitivity of the thyroid to thyrotrophic hormone.
3) Disturbed feed-back mechanism ( ) pit. & thyroid → the pit. continues to secrete TSH Although T4 & T3 are high in i blood .

C/P :

a) Onset: usually gradual
b) Course : chronic progressive course with frequent acute exacerbations.
c) Occasionally the disease shows spontaneous recovery as a result of exhaustion of thyroid cells >

Symptoms :

a) General :

1) Severe asthenia.
2) Rapid lass of wt .
3) Intolerance to heat & on the contrary the pt likes winter time .
4) Excessive sweating .
5) Swelling in the thyroid region with attacks of suffocation if the swelling is big or has a retrosternal extension .

b) Nervous :

a. Irritability and anxiety : pts are characteristically started by any sudden stimulus .
b. Tremors of the hands & tongue (fine)
c. Myasthenia .
d. Weakness & wasting of some of the muscles of the L.L.s mainly the Quadriceps due to thyroid myopathy.

c) C.V.S. :

a. Exertional dyspnea .
b. palpitation .
c. rarely angina .

d) G.I.T. :

a. ↑ appetite
b. Polyphagia & inspite of that, still ↓↓ wt.
c. Tendency to diarrhea.

e) Urinary :

Polyuria due to :

a. Excess formation of metabolic H2O .
b. ↑ Renal B. flow .
c. ↑ Fluid intake as apart of polyphagia.

f) Gonadal :

a. ↑ lipido , in the early stages .
b. in females : menstrual disturbances ; started by polymenorrhea & menorrhagia and ended By amenorrhea.

g) Skeletal :

Osteoporosis of bones → Generalized bone aches.

Signs :

A) General :

1) Wt loss.
2) ↑sweating.
3) Goiter :
   i. the gland is usually moderately enlarged flesh in consistency , smooth surface moves freely with deglutition .
   ii. The overlying skin shows dilated veins, pulsations , thrills and audible bruits due to ↑vascularity .
4) Skin :
   i. thin , warm & sweating .
   ii. Palms are warm & Sweaty contrary to psycho neurotics in whom the hands are cold and sweating .
   iii. Hyperpigmentation if present never affect mucous membrane (as Addison)
5) Eye signs:

Exophthalmos:

A) Benign : probably related to ↑TSH , improve by ttt of thyroticosis and usually mild .

B) Malignant : proptosis +++, oedema of eyelids chemosis in conjunctiva

- usually related to ↑ in exophthalmos producing substance ẅ :
  1- ↑ retrobulbar fat .
  2- ↑ retrobulbar mucopolysaccharides .
  3- weakness of ocular muscles .

  this type ↑ed after anti-thyroid therapy.

1. Von Graefe's sign :

Lagging of the upper eye lib when the patient is asked to look gradually down → rim of the sclera exposed .

2. *Joffroy's sign :*

Lack of corrugation of the forehead when looking up

3. *Mobius sign :*

Lack of convergence when looking to a near object

4. *Stellwag's sign :*

Starring and gazing look + ↓ blinking

5. *Dalrymple's sign :* Advanced von Graefe's

when pt looks straight forwards → a rim of sclera can be seen above the cornea

6. *Ophthalmoplegia :*

With malignant exophthalmos .

B) Nervous signs :

1. Irritability and anxiety.
2. Fine tremors of fingers & tongue ẅ appear more by asking I pt to out stretch I hands & abduct I finger .
3. Myasthenia gravis like picture : with rapid fatigability of ms but é out good response to prostigrmine .
4. My apathy : acute or chronic , atrophic type of myopothy , mainly affect quadric cops ocular ms

C) C.V.S. :

1. pulse: - rate : ↑ even during sleep
   - rhythm : A.F. or flutter
   - ch' : water hummer pulse.
2. Bl. pressure:
   - ↑↑↑ systolic, ↓ diastolic →↑ pulse pressure
3. heart:
   - dilatation Of both ventricles
   - ↑ed HT. sounds.
   - haemic murmurs. Commonly systolic over P.M. areas.

Investigations:

1. Sleeping pulse rate.
2. BMR.
   * normal range : +15 to -15
   * in thyrotoxicosis, it is high.
   * BMR is not accurate may be ↑↑ in:
     - non basal conditions.

- pregnancy.
- parkinsonism.
- H.F.
- blood diseases as polycythemia & leukemia.

3. P.B.I (protein bound iodine):
   - normally: 4-8 mg/ 10cc.
   - in thyrotoxicosis →↑↑
4. T3 , T4 , TSH.
5. I131 (radioactive iodine uptake) ↑
6. serum cholesterol: ↓
7. OGTC: lag curve.

2ry Thyrotoxicosis

As primary except in :

1. Age → older
2. onset → more gradual.
3. gland → show nodular goiter or adenoma.
4. C.V.S manif. → more marked
5. nervous manif. → less marked
6. exophthalmos → mild
7. response to med. ttt → not good.

Treatment of hyperthyroidism :

(A) Medical ttt :

- **Indications :**
  1. all cases of 1ry hyperthyroidism should receive a trial for medical ttt.
  2. in 2nd type: medical ttt is given as pre-operative preparation.
  3. refusal of operation.
  4. general contraindications for operation.
- **Contraindications :**

  Retrosternal goiter: as the goiter may swell under med ttt → mediastinal syndrome.
- **Lines of med. ttt :**

  → (1) mental & physical rest : esp. in sever cases.

  → (2) Diet :

  * high protein diet to compensate for the ↑ed protein catabolism.

* Excess vit. Esp. A,B,C.

→ (3) sedation : using tranquilizers e.g. diazepam derivatives.

→ (4) Anti-thyroid drugs :

(a) Iodine & iodides: ...

- *Preparations* : lugol's iodine= 5% I2 in KI 10%
- *Action* : antagonize TSH →↓ size,↑ fibrosis, ↓ vascularity
  - this action can not be maintained for more than 3 weeks, so it's used as preoperative only.
- *Dose*: 5 drops t.d.s, ↑ ed gradually to 15 drops t.d.s
- *Toxicity* :
  1. ↑↑ salivation.
  2. parotid swelling.
  3. Skin rash.

(b) thiouracil derivatives:

- *Preparation* :
  - CH3 thiouracil
  - C2H5 (propel) thiouracil.
- *Action* : inhibits the enzymes necessary for [I2 ↔ tyrosine] & [T2 ↔ T4] → ↓ T4 & T3 → ↑ exophthalmos.
- *Dose* : c2Hs thiouracil: 200mg t.d.s until BMR become normal, then maintenance dose 100m.g./d.
- *Side effects :*
  1. skin rash.
  2. ↓ WBcs.
  3. ↓ agranulocytosis → vit. B6 20mg/d.
  4. hepatotoxicity.
  5. nephrotoxicity.

(c) Mercazol derivatives: ...

- *Preparation* : mercazole, neomercazole (immedazol carbinazol).
- *Action & toxicity* : as thiouracil.
- *Dose* : 1/10 of propyl thiouracil.

(B)Surgical ttt :

* *Indications* :

1. all cases of 2ry thyrotoxicosis.
2. failure of med. ttt.
3. recurrence of symptoms after each time of med ttt.

4. retrosternal goiter.
5. cosmotic.

* *Premedication* :

Medical ttt until BMR drops as low as possible then stop thiouracil or mercazole & give lugol's iodine for 2 weeks.

* *Operation* :

Subtotal thyroidectiomy.

(C)Radioactive Iodine :

* *indications :*

1. elderly thyrotoxic patients (>50y).
2. recurrence after surgery.
3. thyrotoxic H.F.

* *contraindications* :

1. young age.
2. very big goiter.
3. pregnancy & lactation.
4. retrosternal goiter.

* *Dose* : 180u curie/g.m. of thyroid.

* *Side effects :*

1. Myxedema.
2. B.M. depression.
3. malignant transformation.
4. swelling of the gland → tracheal compression.

Treatment of malignant exophthalmos :

Medical:

1. salt restriction diuretics.
2. anti-thyroid therapy + small dose of thyroid extract (L. Thyroxine 0.1 mg)

Surgical:

orbital decompression by removal of a part of the roof or lateral wall of the orbit.

Thyroid Crisis

Mostly during operation or immediately after it.

Predisposing factors:

1. inadequate preparation.

2. infection.
3. +++ emotions.

C/P:

Thyrotoxicosis +

1. hyperpyrexia (>40 ◦c).
2. +++ sweating.
3. abd. Pain & diarrhea.
4. stuper → coma.

Treatment :

1. Neomercazope 6- 8 tab/8h (tab = 5m.g.) naso-gastric tube.
2. Na iodide: 1-2 g.m./ 24 hrs I.V. infusion.
3. inderal I.V. infusion 1-10 mg/min. in ICU under monitoring.
4. hydrocortisone 100m.g./ 6h then after improvement gradual ↓ doses then change to tab.
5. Symptomatic :
   (A) fluids & electrolytes: especially glucose for ttt of hypoglycemia.
   (B) Hyperpyrexia.
   (C) H.F. & A.F.
   (D) Sedation & O2.

Hypothyrodism:

Causes:

1. congenital absence.
2. lingual thyroid.
3. operative removal.
4. thyroiditis.
5. destruction by x-ray, radio-active I2 or radium.
6. exhaustion after hyperactivity.

Clinical types :

1- Cretinism.
2- Adult myxoedema.
3- Juvenile myxoedema.
4- Hypopituitary myxoedema.

Cretinism

Etiology:

1. congenital absence of thyroid gl. ((thyroid cretinism)).
2. congenial enzymatic defect in the formation of T4 ((metabolic cretinism)).
3. endemic goiter ((endemic cretinism)).

C/P:

1- **Charachterestic facial features :**
   a. dull apathetic look.
   b. Depressed bridge of nose.
   c. Wide apart eyes.
   d. Big thick lips.
   e. Big protruded tongue.

2- **Dwarfism :**
   disproportionate dwarfism → span < height
   → lower ½ < upper ½

3- **Retarded steps of development :**
   Late at sitting, standing, walking, talking, teething.

4- **Cutaneous :**
   a. thick, cool, pale rough skin
   b. hairs → scalp alopecia ++

5- **Muscular :**
   a. muscular weakness flabbiness.
   b. Pot belly abdomen: due to weakness of abd. ms.

6- **G.I.T. :**
   - constipation +++.

7- **Nervous system :**
   a. idiots = mental backward.
   b. Quiets = abnormal.

8- **C.V.S. :**
   - ↓ heart rate

9- **Gonadal :**
   - manifested when reach purity →↓↓↓.

Investigations:

1. T3, T4, T.S.H. → ↓
2. Protein bound iodine → < 4 ugm%.
3. radioactive iodine uptake : very low except in type due to cong. Enzymatic block in ẅ there is increased iodine uptake.

Treatment :

Thyroid extract, started by ⅛ grains t.d.s and gradually increased to ½ grains t.d.s.

Adult myxoedema

Aetiology:

(1) primary myxoedema:

- occurs in ♀ without an apparent cause.
- Age 35-50 years.
- Probably caused by an auto-immune reaction because antibodies against thyroid could be deleted in the blood.

(2) endemic goiter

(3) iatrogenic → over ttt of thyrotoxicosis e.g. anti-thyroid drugs, thyroidectomy or the use of big doses of radio-active iodine .

(4) thyroiditis → specially Hashimoto's.

(5) malignant thyroid ((may be)).

C/P:

Symptoms:

(I) General :

- general asthenia.
- Over weight.
- Intolerance to cold → in cold days sever myxedematous patients may → hypothermic coma.

(II) Nervous system :

- Mental dullness & ↓ alertness.
- Laziness, numbness tingling of limbs

(III) C.V.S. :

- CHD → A.S.H.D.
- ↑ cholesterol.

(IV) G.I.T. :

- Constipation +++ up to intestinal obstruction.
- Anorexia.

(V) Gonadal :

- ↓ lipido in both sexes.
- Impotence in males.
- In females: menestrual disturbances oligomenorrhea, amenorrhea & rarely menorrhagia.

Signs:

i. General :

- choracterestic facial features:
  - dull look
  - puffy lids
  - absent hairs in the outer ⅓ of eye brows.
  - Thick lips.
- ↓ temperature.
- locally → may be: goiter or scar of previous operation.

ii. Cutaneous :

(1) skin: thick, cool, rough.

(2) Myxoedematous deposition.

- Legs → pretibial Myxedema.
- Eye lids cheeks, supraclavicular & dorsum of hands.

(3) Hairs → - patches of alopecia.
- rough

iii. Nervous System :

- mental back wardness.
- Poly neuropathy.
- Myotonia with delayed relaxation of ankle jerk
- Acute psychosis

iv. C.V.S. :

1. ↓ H.R.
2. cardiac enlargement due to:
   a. myxoedematous deposits in myocardium.
   b. Myxoedematous deposits in pericardium.
   c. C.H.D → ((athero- A.S.H.D))

Investigation:

1. T3, T4, TSH ↓↓↓

2. BMR: ↓↓ < -30
3. ↓ protein bound iodine < 4 microgram%
4. radio active iodine up take < 16%.
5. Serum cholesterol > 300gm%
6. C.B.C.
    a) microcytic hypochromic anemia responding to Fe.
    b) Macrocytic hyperchromic anemia responding to B_{12}
    c) Macrocytic hyperchromic anemia responding only to T4

D.D.:

1. anemia
2. myocarditis
3. arthritis.
4. subacute nephritis N.S.

Treatment :

1- Thyroid extract: ½ grain t.d.s gradually ↑ to 1 grain t.d.s.
2- L. Thyroxin 100 ugm t.d.s.
3- T3 200 ugm t.d.s.

Juvenile Myxedema

Occurs around the age of puberty.

C/P: A mixture of cretinism and Myxedema.

Hypopituitary Myxedema

- Differs from adult Myxedema in:
    1. skin → not thick.
    2. cholesterol → not ↑
    3. pubic & axillary hairs → completely absent.
    4. T3, T4, BMR, RAIU → improves after TSH.
    5. hypoglycemia → more.
    6. signs of ↓ of some other pituitary hormones e.g. → M.S.H.

Parathyroid gland

Anatomy:

4 glands (2-6) commonly on the posterior aspect of the thyroid.

Physiology:

The gland secretes "parathyroid hormone" (parathormone) ẅ →

(1) on bones:

↑ resorption → mobilization of Ca^{++} , P^{+++} (due to stimulation of osteoclasts).

(2) On kidneys:

↑ tubular reabsorption of Ca^{++} , ↓ P^{+++}

(3) On intestine:

↑ Ca^{++} absorption

↑ plasma Ca^{++} , ↓ plasma P^{+++}

↑ Ca^{++} , P^{+++} excretion

so, the most important function of the hormone is to maintain normal serum calcium.

❖ Ca^{++} , P^{+++} metabolism :

normal serum Ca^{++} level = 9-11 mg%

1. ionized 60%, important for neuromuscular excitability.
2. non ionized 40%, combined ē albumin.

↓ pH → ↑ ionized Ca^{++}

Importance of Ca^{++} :

1. bone formation ē P^{+++}.
2. nerve impulse transmission.
3. neuromuscular excitability, ms. contraction & normal bl. coagulation.

❖ *Serum P. Level* :

3-3.5 mg%

Ca^{++} × P = constant (about 35) [due to feed back mechanism.]

❖ *Absorption*:

- Small intestine specially its upper part.
- ↑ by: ↑ intake, ↓pH, D3
- ↓ by: * ↑ mg. * ↑ Ld.
  * ↑ aluminum. * ↑ fatty acids.

• Bone formation :

(1) bone matrix (osteiod)

(2) deposition of Ca^{++} , P^{+++} = mineralization of this matrix.

Need phosphatase (acid & alkaline).

❖ ***Anabolic substances*** : - Androgens
- Growth hormone
- Thyroxin in physiological amount
- Vit. A & C ± B.

❖ ***Catabolic substances*** :

* Glucocorticoids * Thyroxin in excess

- **Osteoporosis:**

= Defective formation of bone matrix but what is formed is well calcified

AE :

1. ↓ anabolic substances.
2. ↑ catabolic substances.
3. geriatric in ♂ , postmenopausal in ♀
4. ↓ Pit.
5. ↑ thyroid
6. Cushing.
7. steroid ttt.
8. malnutrition.
9. obesity
10. prolonged immobilization.

- **Hormones affecting Ca^{++} balance :**

(1) Parathormone.

(2) D3 (cholecalciferol): must be activated by the kidney :

- ↑ Ca^{++} absorption
- Direct calcific effect on bone.

(3) Calcitonin: by Para-follicular cells of thyroid & C- cell (Calcitonin cells).

Hypoparathyroidism
(a part of hypo Ca^{++})

AE:

(I) ↓ ionized Ca^{++} è ↓ of total Ca^{++} :

- Hypoparathyroidism :
  - Idiopathic autoimmune.

- Surgical.
- Radiological / thyroidectomy.

- Pseudo Hypoparathyroidism :
  - Rare hereditary.
  - Parathyroid glands are normal but the organs (bone & kidneys) are resistant to the effect of Parathormone.
  - = end organ or target organ sensitivity
  - It is similar to pathogenesis of Nephrogenic D.I.

C / P : (of pseudo ↓ para)

1. ↓ serum Ca^{++} & ↑P
   ↓ urine Ca^{++}
   normal alk. Phosphate.
2. round face, short stature, short metacarpals, fingers.
   ↑ index > middle.
3. Diet ↓ of vit. D.
4. G.I.T: Malabsorption, gastrectomy, obst. jaundice.

Rickets in
- ↓ serum Ca^{++} (or ± nl)
- ↓ serum P (or ± nl)
- ↑ alk. Phosphatase

5. Chronic renal failure due to :
   - P. retention.
   - vit. D. resistance.
   - ↓ca absorption.
   - tetany rare duce to acidosis
6. medullary carcinoma of thyroid = ↑ calcitonin.
7. Ac. Pancreatitis : soaps of Ca^{++}.

(II) ↓ Ionized Ca^{++} with normal total Ca^{++} :

- Alkalosis :
  - ↑ Ventillation : [Fever, Hysterical, Salisylate poisoning]
  - Prolonged vomiting (Gastric tetany).
  - ↑ Alk. Intake.

N.B. :

- Latent tetany : Ca^{++} = 6 - 8 mg%.
- Manifest tetany : Ca^{++} < 6 mg%.

- in cases of ↓ Ca^{++} not due to ↓ Parathyroid (nL. Gland) tetany is rare due to 2ry ↑ in Parathyroid → mobilize bone Ca^{++} → ± serum nL.

Treatment :

- Tetany : Ca^{++} gluconate 10% I.V. during the attacks.
- for Ch. Cases : - Ca^{++} salts orally.
  - ↑ dietary Ca^{++} .
  - Vit. D : orally & I.M.
  - Parathormone.

Tetany

= ↑ neuromuscular excitability due to ↓ ionized Ca^{++} .

1) Chvosteck's sign :
   taping (VII nerve) in front of ear → contraction of ala-nasi tremors of mouth.
2) Trousseau sign :
   Inflate the cuff of sphygmomanometer >systolic → carpopedal spasm.

Hyperparathyroidism

1ry, 2ry, 3ry .....& pseudo

1ry ↑ parathyroid:

AE:

- Adenoma of one or more gland (90%)
- Hyperplasia usually of the 4 glands
- Adenocarcinoma = rare

Effects:

1) ↑↑ Ca^{++}
2) ↓ P (± nl) due to ↑ mobilization of bone Ca^{++} & P.
3) ↑ Alk. Phosphatase (± nl).
4) ↑urinany Ca^{++}&p may →
   - Ostea malacia
   - Later: ositis fibrosa cystica
   - Manifestatic calcification → kidney tubules → nephro calcinosis → Ch.R.F.

❖ **Manifestations:** (symptoms) ←