TSH ↓
T3 ↑ ⇒ Hyperthyrodism (1ry) ↔ Graves / Goiter / Toxic nodules
T4 ↑

↑
↑ ⇒ Hyperthyrodism (2ry) → TSH-secreting adenoma.
↑ pit

TSH ↑
T3 ↓ ⇒ Hypothyrodism (1ry) → Hashimoto. (anti TPO)
T4 ↓

↓
↓ ⇒ Hypothyrodism (2ry) → pitu. Tumor.
↓

Thyroid development

The fetal thyroid arises from an outpouching of the foregut at the base of the tongue (foramen cecum).

It migrates to its normal location over the thyroid cartilage by 8-10 wk of gestation.

The thyroid bilobed shape is recognized by 7 wk of gestation.

Thyroglobulin synthesis occurs from 4 wk, iodine trapping occurs by 8-10 wk, and thyroxine (T4) and, to a lesser extent, triiodothyronine (T3) synthesis and secretion occur from 12 wk of gestation

Maturation of the hypothalamic-pituitary-thyroid axis occurs over the second half of gestation, but normal feedback relationships are not mature until 1-3 mo of postnatal life

* premature at risk ↑ transient ↓

T4 —deiodination→ T3
more — more active

Bind to → TBG, albumin.

Thyroid changes at birth

Maternal T4 plays a role in fetal development, especially tha of the brain, before the synthesis of fetal thyroid hormone begins.

At birth, there is a surge of TSH that peaks by 12 hrs of age u to the next 2-5 days

Followed by a rise in T4 and T3 levels, which peak during the first day of life and then slowly fall until 1 week -2 weeks of lif

Important for interpretation of newborn screening tests

Prematures and sick babies have the same changes with lesser quantity

Can cross the placenta

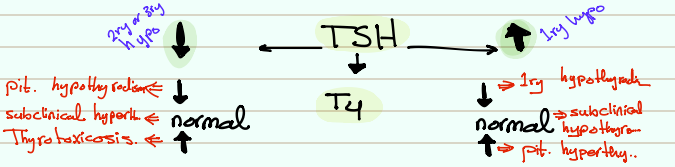
screening test.

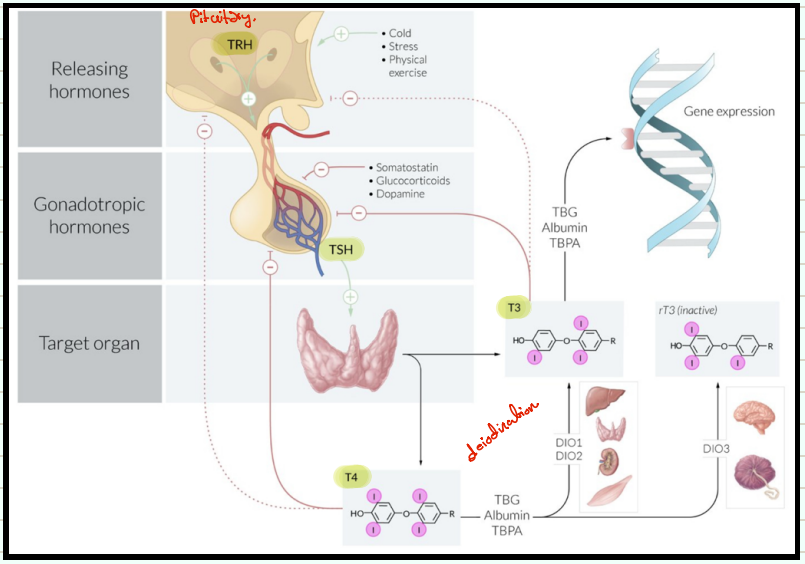
asymptomatic

* surge → shortly after birth! 12hr!

#Thyroid H. actions:-

- ↑ oxidative metabolism ⇒ . O_2 consumption, . BMR, . glucose metabolism, . fat metabolism.
  In Intrauterine life?
- promote growth & development
- Essential for normal myelination
- Augmentation of cardiac function.
- Important for normal reproductive function.





Hypothyroidism

Congenital hypothyrodism.

- ✳ preventable cause of intellectual disability.
- ✳ Mostly → primary. ♀:♂ 2:1.

 # RF :-
- Multiple gestation
- prematurity.
- babies of old age mother
- Asian & hispanic
- Down syndrome.

Cong. ↓ of thyroid secretion → arrested physical & mental develop. & dystrophy of bone & S.T → **cretinism**

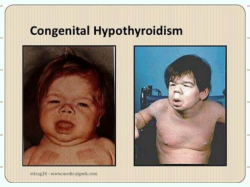
Clinical manifestations:

- Respiratory distress
- Large posterior fontanelle
- Abdominal distention
- Lethargy and poor feeding
- Prolonged Jaundice (may be the earliest sign)
- edema
- Umbilical hernia
- Mottled skin
- Constipation
- Dry skin
- Hoarse cry(cry little.sleep much,poor appetite)

By age 3–6months the clinical picture is fully developed
- Growth is stunted,extremities are short. Head size normal or increased
- Open posterior fontanelle Dx:- Down
- The mouth is kept open.and large tongue protruding
- Dention is delayed
- Neck is short and thick
- Myxedema of the eyelids, dorsum of hands and ext genitalia
- Carotenemia :yellow skin white sclera, Skin is dry and scaly little perspiration
- Scalp is thickened hair is coarse brittle and scanty
- Low hair line
- Broad Hands , short fingers

- Bone age delay
- Brain maturation
- thyroid hormone is essential for bone and brain maturation
- Development is retarded

- Muscles hypotonia with pseudohypertrophy



Mostly non. ✳ Dysgenesis 90% → etiology
- no goiter
- aplasia 2/3 (the thyroid is completely absent)
- Hypoplasia or ectopic. :more ectopic
- genetic defect → transcription factors.
- CVS, GIT, skins
- usually sporadic.
- Factor (Normal) TTF1, 2, PAX-8.

etiology:
- TRBAb — Thyrotropin receptor blocking Ab. rare. transient → remission in 3months.
- Dyshormonogenesis → could be transient. dis. of intrathyroid metabolism. ass. w→ Goiter. -inherited -may during pregnancy
- Defective iodine Transport metabolism.
- Pendred syndrome → AR, SNHL

The **7 P's** of congenital hypothyroidism are **P**ot-bellied, **P**ale, **P**uffy-faced, **P**rotruding umbilicus, **P**rotuberant tongue, **P**oor brain development, and **P**rolonged neonatal jaundice

Most infants at birth ⇒ asymptomatic.
- weight & length → normal
- HC → slightly ↑

Screening crucial! 5 days – 2 weeks or month later

Hints:
- acrocyanosis
- hypothermia.
- > 42 wks (gest.)
- Birth weight >4kg.
- ass. anomalies

Ty T3↓ Low, TSH↑ >100 mU/L

Does it cause precocious puberty? No.
Thyroxin effect more at → Child hood Puberty

- Thyroid US.
- Scintigraphy. but treatment should not be delayed to obtain such imaging before 2 weeks.
- Thyroglobulin ↑: neonates Graves & autoimm T endemic goiter.
- Skull xray.
- ECG

وش نعمل جالدنيا ؟
1. Initial blood Thyroxine assay. + TSH assay follow up. if Ty < 10th percentile.
2. TSH assay
3. Simultaneous Ty & TSH

Treatment ✳

Sodium Thyroxine Ty.
- New born → 10-15 ug/kg
- Childhood → 3-5 ug/kg
- Adults → 2 ug/kg

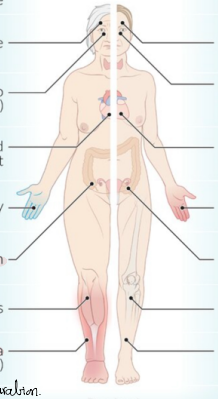
#Aquired hypothyroidism

- **Etiology**

1. Lymphocytic thyroiditis most common
2. Autoimmune polyglandular syndome
Down ,turner,klinfelter syndromes
3. Subtotal thyroidectomy
4. Histiocytic infiltration
5. Secondary ,medication or irradiation

May develop during first year of treatment :
- Deterioration school work
- Poor sleeping habit
- Restlesness
- Short attention span
- Behavioral problems

Findings	Hypothyroidism	Hyperthyroidism
Metabolic	Intolerance to cold Weight gain Decreased appetite	Intolerance to heat Weight loss Increased appetite
Neuropsychiatric	Excessive fatigue	Irritability, restlessness
Periorbital findings	Periorbital edema (due to generalized myxedema)	Periorbital edema, lid lag, and exophthalmus (in Graves ophtalmopathy)
Cardiovascular	Bradycardia, decreased cardiac output	Tachycardia, palpitations, hypertension
Skin	Cold, dry	Warm, moist
Gastrointestinal	Constipation	Hyperdefecation
Musculoskeletal	Cramps	Osteopathy
Edema	Generalized myxedema (initially pretibial)	Pretibial myxedema (in Graves disease)
Myopathy	* delayed osseous maturation. * precocious puberty.	Proximal
Reproduction	♀ Menstrual disorders ♂ Decreased libido, infertility	
Hair	Hair loss	



#Hashimoto

♀>♂ x4-7 times.
insidious onset after 6 y
peak → adolescene.

MC presentation ⇒ Growth retardation *
Goiter. *

Most are euthyroid

Associated auto immune diseases:
DM1,Adrenal insufficiency ,hypoparathyroidism, pernicious anemia, vitiligo ,alopecia,cong.rubella
Higher incidence in turner and trisomis 21

Clinical features

- **Early-stage**
  - Primarily asymptomatic
  - **Goiter**: nontender or painless, rubbery thyroid with moderate and symmetrical enlargement [2]
  - **Hashitoxicosis** may occur: transient thyrotoxicosis due to follicular rupture of hormone-containing thyroid tissue that manifests with signs of hyperthyroidism (e.g., irritability, heat intolerance, diarrhea)
- **Late-stage**
  - Thyroid may be normal-sized or small if extensive fibrosis has occurred.
  - **Signs of hypothyroidism** (e.g., cold intolerance, constipation, fatigue)

- T3 T4 normal ↑TSH.
- Antithyroid peroxidase
- Antithyroglobulin ab.
- Thyroid U/S. → scattered (hypoechogenicity.
- Thyroid scan.
- Biopsy (definitive)

✓ -Levothyroxin.
if eu → Follow up 6-12 months.
if goit. normal TSH → No Tx.

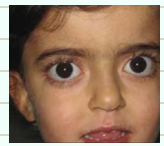
Hyperthyroidism.

#Graves# ♀>♂ 5:1
MCC of hyperthyro in children.
• gradual onset.

#Enlargement ⇔ spleen, thymus, L.N
peripheral lymphocytosis.
* TRSAB ↑ ratio
* TRBAB
ass → HLA-B8 HLA-DR3.
addison DM1 MG Celiac SLE Rt arthritis vitiligo pernicious anemia ITP.

→ earliest sign → emotional disturbances.

Clinical manifestations cont
GRAVES DISEASE
- Tremor
- Voracious appetite with loss of weight
- Goiter found in most pt
- Exophthalmos noticeable but mild ,lid lag Although 50–75% of children with Graves disease have some eye finding, the symptoms are much milder than in adults.
- Skin smooth and flushed, excessive sweeting
- Muscular weakness
- Tachycardia palpitations dyspnea cardiomegaly,atrial fibrillation rare complication
- Mitral regurgitation
- Systolic B/P and pulse increase90
- Advanced skeletal maturation and craniosynostosis (neonatal graves) sutures closed very early.
- Note: Eye manifestations are much less common in children than adults



* TRAb
To diagnosis & tx of Graves not others.

#subclinical hyperthyroidism
↑TSH
normal T4.

Differential diagnosis (cont)

If precocious puberty ,café au lait spot and polyostotic fibrous dysplasia McCune-albright
Generalized thyroid hormone unresponsiveness (Thyroxine resistance)
High level T3 but levels TSH elevated or normal
Exogenous thyroid hormone, T4 TSH same as Graves but thyroglobulin is very low.

#Thyroid crisis (storm)

Acute onset
Hyperthermia
Severe tachycardia
Restlesness
Delirium coma death

✓ -Medical therapy ⇒
- Radioactive iodine ablation effective /safe → hypothyroidism
- Subtotal thyroidectomy
  - hypoparathyroidism
  - vocal cord paralysis
  - recurrent

ATD
- Propylthiouracil PTU ✓ pregnancy /lactating
- Methemazole ✓ Peds

→ Transient leukopenia ± urticarial rash

- Badrenergic Y agents propranolol. 0.5–2 mg/kg.

#Congenital hyperthyroidism#

fetal tachycardia.
Mother → Graves.