Disorders of the Thyroid Gland

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Lec 9

- **Hyperthyroidism**
- **Definition**
- Hyperthyroidism is a condition in which the thyroid gland secretes **excess amounts of thyroid hormones (T_3 and T_4)**, leading to increased metabolic activity in most body tissues.

Primary Hyperthyroidism

- Over activity of the thyroid gland itself → ↑ secretion of thyroid hormones.

  Examples:

- **Graves' disease** (autoimmune stimulation of TSH receptors)
- **Toxic adenoma** (autonomous hormone secretion)

Secondary Hyperthyroidism

- Due to ↑ secretion of **TSH** from the **pituitary gland**.

Tertiary Hyperthyroidism

- Due to ↑ secretion of **TRH** from the **hypothalamus**, which over stimulates the pituitary–thyroid axis.

Graves' Disease (Diffuse Toxic Goiter):

1. The most common cause.
2. An autoimmune disorder in which **thyroid-stimulating immunoglobulins (TSI)** bind to and activate the **TSH receptors** on thyroid follicular cells.
3. This mimics the effect of TSH and causes **continuous stimulation** of the gland → hypertrophy, hyperplasia, and excessive hormone secretion.

Pathophysiology

- Increased T_3 and T_4 → enhanced **basal metabolic rate (BMR)** and **oxygen consumption** in most tissues.
- ↑ Protein and fat catabolism → weight loss and muscle weakness.
- ↑ Sympathetic nervous system activity due to increased sensitivity to catecholamines (↑ β-adrenergic receptor expression).
- Negative feedback → **low plasma TSH** levels.

Clinical Manifestations

1. Metabolic effects:

- **Heat intolerance** and **excessive sweating** due to ↑ metabolic rate.
- **Weight loss despite increased appetite** because metabolism exceeds intake.

2. Nervous system effects:

- **Tremor**, **nervousness**, **anxiety**, and **insomnia** — from ↑ sympathetic activity.

3. Cardiovascular effects:

- **Palpitations** and **tachycardia** (sometimes **atrial fibrillation**).
- **Systolic hypertension** due to ↑ cardiac output.
- In severe cases → **heart failure** from persistent overwork.

4. **Muscular and general effects**

- **Fatigue** and **muscle weakness** from protein breakdown.

5. **Reproductive effects**

- **Oligomenorrhea** or **amenorrhea** in females.

6. **Specific sign (Graves' disease)**

- **Exophthalmos** (protrusion of eyeballs) due to immune inflammation of orbital tissues

Exophalmus

- **Treatment**

1. **Antithyroid drugs:** e.g., *Methimazole* or *Propylthiouracil* (inhibit thyroid peroxidase).
2. **High doses of iodide:**

- When iodide is given in a very high dose (not in deficiency), it produces a temporary inhibition of thyroid hormone secretion from the gland.

3. **Surgical Thyroidectomy**
4. **Radioiodine Ablation** in advanced cases ,the patient receives radioactive iodine, which is selectively taken up by thyroid cells. The radiation destroys the hormone-secreting cells selectively and permanently.

- **Hypothyroidism**
- **Definition**
- A state of **deficient thyroid hormone secretion** resulting in **slowed metabolism** of body tissues.
- **Causes**
- **Primary thyroid failure:** due to :

1. Autoimmune destruction (e.g., Hashimoto's thyroiditis)
2. Iodine deficiency
3. Congenital absence of the gland.

- **Secondary hypothyroidism:** due to pituitary TSH deficiency.
- **Tertiary hypothyroidism:** due to hypothalamic TRH deficiency.

- **Pathophysiology**
- **Decreased T_3 and T_4** → reduced metabolic rate and sluggish energy production.
- There is **accumulation of mucopolysaccharides**, mainly **hyaluronic acid** and **chondroitin sulfate**, in the interstitial spaces of the skin and other tissues.
- These substances **bind water and increase tissue viscosity**, producing a **non-pitting type of edema** called **myxedema.**

- **Slowed protein synthesis and enzymatic activity, slowing all metabolic and neural processes.**
- **Impaired lipid metabolism** → hypercholesterolemia and atherosclerosis.
- **In women:** disturbances in menstrual cycle (menorrhagia or polymenorrhea).

- **Clinical Manifestations in Adults (Myxedema)**
- Puffy face, baggy eyes
- Dry skin, brittle hair, hoarse voice
- Cold intolerance
- Weight gain with poor appetite
- Constipation
- Bradycardia, ↓ cardiac output
- Fatigue, sleepiness, mental slowing
- Anemia
- In severe cases → *Myxedema coma*
- **Treatment** :

1. Hormone replacement therapy: Oral levothyroxine (T_4) for life.
2. Correction of iodine deficiency if present.

Myxedema

Cretinism

- This condition is called congenital hypothyroidism or cretinism. It occurs when the thyroid gland fails to produce enough thyroid hormones during the critical period of brain and body development.
- **Causes**:
- **Congenital absence** or underdevelopment of the thyroid gland (thyroid dysgenesis).
- **Genetic enzyme defects** in thyroid hormone synthesis.
- **Severe iodine deficiency** in the mother during pregnancy

➢ **Treatment** of congenital hypothyroidism is lifelong thyroxin (T_4) replacement.

- Early treatment prevents growth and mental retardation, but delayed therapy cannot reverse brain damage , mental retardation becomes permanent.

Congenital Hypothyroidism Findings

Remember 6P's

- Pot-bellied
- Pale
- Puffy-faced child with
- Protruding umbilicus
- Protuberant tongue
- Poor brain development

Goiter

- An **enlargement of the thyroid gland**, which may occur in both hyperthyroid and hypothyroid states.
- **Mechanism**
- In iodine deficiency, low thyroid hormones → ↑ TSH secretion → gland hypertrophy (simple goiter).
- In Graves' disease, continuous stimulation by antibodies also causes diffuse goiter.